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Architecture and Urbanisation in Bronze Age Cyprus: local and regional innovations in materials, technology and social representation

PhD

School of Archaeology, Geography and Environmental Science

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Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

Marialucia Amadio

ABSTRACT

The thesis project aims to investigate the formative period of urbanism in Cyprus and the socio-cultural and economic transformations that characterised the passage from the village-based rural society of Early Bronze Age Cyprus to the urban society of Late Bronze Age Cyprus (c. 2400-1100 BC), by using architectural evidence as the key data-set. This research aims to understand how the development of new forms and concepts of architecture, and the increasing appearance of social, cultural and economic forms of complexity at the end of Prehistoric Bronze Age Cyprus are mutually constituted.

Recent studies in Cypriot urbanism have stressed the need of multi-scalar data-sets to analyse the history and organisation of urban centres from diachronic, spatial and structural perspectives, and to pay particular attention to the analysis of non-elite areas, since these are recognised as fundamental in the examination of development of social and cultural identities and roles (Manning *et al.* 2014, 9; Fisher 2014b). Middle Bronze Age Erimi-*Laonin tou Porakou* (MC I-LC I, c. 1950-1650 BC), offers a good case-study to investigate this topic, as it includes a range of key contexts to analyse social, cultural and economic developments of the recent Cypriot prehistory, and to enhance the analysis and definition of the formative period of urbanism and complexity in Cyprus.

The analytical approach applied in this research is multi-scalar and interdisciplinary as it combines field practices and macro analysis of architectural forms, buildings, spaces and fixtures, artefacts and archaeobotanical remains, with micromorphology and high resolution FTIR, XRF and SEM analyses of stratigraphic sequences, deposits and materials within buildings and in settlement areas, in order to generate a more holistic data-set, with which to analyse the study-context at different spatial and temporal scales.

This multi-scalar data-set provided an effective framework to examine the formative process of urbanisation and complexity in Cyprus, by delineating aspects of transformations at household and settlement scale at Middle Bronze Age Erimi-*Laonin tou Porakou* through comparisons with other Bronze Age Cypriot contexts. The construction of a transformative built-environment during the recent Cypriot Prehistory materialised the gradual emergence of new forms of social representation and of cultural, economic and political identities, which are conceptually different from household-based systems of Early Cypriot societies and are characterised by spatial and social settings similar to more complex socio-cultural and economic systems of Late Cypriot urban societies.

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Abbreviations

EC = Early Cypriot

MC = Middle Cypriot

LC = Late Cypriot

PreBA = Prehistoric Bronze Age

ProBA = Protohistoric Bronze Age

RPW = Red Polished Ware

DPW = Drab Polished Ware

CW = Coarse Ware

PPL = Plane Polarised Light

XPL =Cross Polarised Light

OIL = Oblique Incident Light

LtP = Laonin tou Porakou

1. INTRODUCTION

1.1 Establishing the context

The study of architecture, from the selection, procurement and processing of raw materials, to the construction and use of buildings as spaces of action and interaction, can provide major insights into the social organisation of ancient communities. Architecture, as ways of organising space and encoding meaning plays an active role in structuring movement and socio-cultural identities (Giddens 1984; Fisher 2007, 1-3), and provides a range of potential avenues for exploring social motivations and rationales in particular contexts and environments, both at the individual and community level (Steadman 2010).

On the basis of these assumptions, this research examines 'architecture' as key-media for analysing socio-cultural narratives in Bronze Age Cyprus and exploring the formation, reproduction and development of past Cypriot societies. In particular, the thesis project aims to investigate the formative period of Cypriot urbanism and complexity, and the socio-cultural and economic transformations that characterised the passage from the village based rural society of Early Bronze Age Cyprus (or Early Cypriot; abbreviated EC) to the urban society of Late Bronze Age Cyprus (also Late Cypriot or LC; see Table 1.2), by using architectural evidence as the focal data-set. The interest of this study, is not only in how people constructed buildings, but also how buildings contributed to the construction and definition of new socio-cultural and economic identities during Cypriot Prehistory-early Protohistory (1850-1750/1550-1450 BC). Through this approach, the intangible aspects of society can be analysed beyond the examination of structural forms and designs (Given 2004, 105; Love 2010, 1). Cypriot Bronze Age architecture is often discussed in terms of its stylistic, functional, technological and chronological attributes and less as the product of human action and intention (e.g. Kargaeorghis 1982; Hult 1983; Wright 1992; Webb 1999; see Section 1.2.3). This research aims to understand how the development of new forms and concepts of architecture, and the increasing appearance of social, cultural and economic forms of complexity at the end of Prehistoric Bronze Age Cyprus (or PreBA, see Table 1.2; Knapp 2004) are mutually constituted.

Recent studies in Cypriot Urbanism have stressed the need of developing multi-scalar data-sets to analyse the history and organisation of urban centres from diachronic, spatial and structural perspectives, and to pay particular attention to the analysis of non-elite areas, since these are recognised as fundamental in the examination of development of social and cultural identities and roles (Manning *et al.* 2014, 9; Fisher 2014b). Middle Bronze Age Erimi-*Laonin tou*

Porakou (MC I-MCIII, c. 1950-1650 BC), offers a good case-study to investigate this topic, as it includes a range of key contexts to analyse social, cultural and economic developments of recent Cypriot prehistory, and to enhance the analysis and definition of the formative period of urbanism and complexity in Cyprus (Manning *et al.* 2014; Fisher 2014a; Fisher 2014b). To address the shortcoming of analytical approaches that are based on single classes of evidence (see Furholt 2016; 1197-1199), this study examines the role of architecture and material culture as media for expressing social reproduction and as the context of social action and interaction, through a multi-scalar and interdisciplinary analysis of architectural materials, forms and practices, and concepts and representations of built space, as well as fixtures and portable objects, in order to produce a more holistic data-set with which to analyse and reconstruct social, cultural and economic trajectories at the end of Prehistoric Bronze Age Cyprus (PreBA III; Knapp 2004).

In what follows, I establish the theoretical context of this study. I begin by examining this work in context through a review of previous approaches to the study of the built environment, with a particular focus on agent-centred theory as the built environment is a lived space imbued with identities and memories that acts as active contributor in the production and reproduction of socio-cultural relationships and identities (Hodder 1992; Dobres 2000; Dobres and Robb 2000; Robb 2010). This is followed by the examination of theoretical and methodological approaches to the study of built environment in Cypriot regional studies, in order to evaluate the strengths and limitations of previous research and to identify possible directions for further development. I then examine the main debates on 'what is urban', and I briefly introduce the arguments about the appearance of urbanisation in Late Bronze Age Cyprus. These sections provide an important basis from which to discuss the importance of analysing the formative period of complexity and Urbanism during Middle Bronze Age Cyprus. In the light of this examination of the research context and rationale, I then consider the aims and objectives of this thesis project. I conclude with an outline of the thesis structure and chapters, briefly reviewing the main arguments examined and discussed.

1.2 Architecture and social reproduction

The terms 'architecture' and 'built-environment' are generally interchangeably used in archaeological research. However, the latter describes more precisely the inter-relationship between humans and the environment, and refers to any physical alteration of the natural environment. Hence, 'built environment' is employed as an abstract concept to define all products of human building activity (Lawrence and Low 1990, 454).

As built-environments are viewed at a variety of scales, ranging from single buildings to neighbourhoods and settlements, the theoretical and analytical approaches to the study of built environment encompass both the concept of 'households' and 'community', and include the analysis of individuals and societies.

The following section is not intended to be and exhaustive review of studies on built-environment but rather a brief examination of previous approaches to frame the theoretical basis of this study, which recognises the built-environment as a primary means by which social transformations occurred in past societies (Fisher 2009a; Parker-Pearson and Richards 1994; Smith 2003).

1.2.1 The social Lives of Buildings

Looking at built-environments as lived spaces that play an active role in expressing and structuring social relationships, implies a divergence from the art-historical approach (e.g. Sackett 1990), which tends to describe 'architecture' as an accumulation of materials, shape and design (Given 2004, 105) and to define buildings as static entities, characterised by stylistic features, construction techniques and functions (Fisher 2007, 3-4). The stylistic classification of buildings, which is applied in studies that retain a predominant art-historical focus, in some cases does not fully acknowledge the dynamic role of built-environment as socially constructed and meaningful context of human action and experience.

As advocated by Rapoport (1980; 1990) and Preziosi (1983) the relationships between human actions and their built-environment is essentially dynamic and reflexive. According to this view, the built environment encodes and communicates meanings through variation in building forms and constitutive elements of architecture; and therefore, it plays a fundamental role in structuring and routinizing of human practices and behaviour (Rapoport 1990). Buildings are constructed with purpose, intention and consideration of histories and are much more than an adaptation to the environment (Rapoport 1969). The relationship between human actions and built environment is also complex as the effects of environment are not direct, passive nor readily predictable (Parker-Pearson and Richards 1994, 2). Social theorists such as Bourdieu (1977) and Giddens (1984) introduced a fundamental conceptual approach, by recognising the dialectical relationship between social structure and human actions (see Robb 2010, 494-496). Giddens' structuration theory retained the linkage between routine action and social reproduction developed by Bourdieu, but expanded the concept of *habitus* (Bourdieu 1977), which refers to the routine actions of daily life within which people create and are at the same time structured by institutions and beliefs beyond their direct control. Giddens highlighted that

human beings are knowledgeable agents, who have particular perceptions of the condition and consequences of their actions. By introducing the concept of *locale*, which is defined as 'the intersection of the social, spatial and physical' (Giddens 1984, 118*)*, he emphasized the central role of architecture in social reproduction, and as the context of social actions and interactions. As a result of structuration theory, spatial structures are not merely identified as areas in which social life unfolds, but rather as media through which social relations are produced and reproduced (Gregory and Urry 1985, 3).

The increasing recognition of the active role of material culture in the production of social life (Hodder 1982; 1992; Hodder 2012; Dobres 2000; Dobres and Robb 2000; Latour 2005; Robb 2010; Smith 2015), has stressed the importance of buildings in affecting human action and interaction. Studies of Environmental Psychology further emphasized this concept, by demonstrating the importance of the affective relationships that people develop with places in which they live, and have recognised the significant role of place attachment in identity formation and social reproduction (e.g. Altman and Low 1990). According to this view, buildings have a social life that contributes and responds to the strategies and desires of individuals and communities (see Kearns 2011, 151). They are active creations that allow human possibilities for interaction, and that change over time as they are constructed, maintained, and abandoned (Fisher 2007; 2009a). Like human actors, each building is characterised by a life-history (Tringham 1995) or biography (Kopytoff 1986; Godsen and Marshall 1999), which is constituted in the meaning accumulated over the duration of building existence and in the memories held by its human occupants.

As stated by Fisher (2009a, 2014a), the recognition of built environments as active agents implies the distinction between 'space', as static physical setting, and 'place', as dynamic, socially constructed and meaningful context of human actions and experience. Built places are contexts for many fields of action, and, most important, they are projects, which involve the engagement of individual and communities and create an 'exercise of social relatedness and endorsement' (Robb 2010, 509). Hence, built-environments are lived spaces, which are imbued with identities and memories that make them both product and facilitator of social life (Fisher 2014a).

Social approaches to the study of built environment have stressed the fundamental role that small scale-everyday activities and routines have in social action and reproduction, as opposed to large-scale processes (Hodder 2005; Kuijt 2000a). As consequence, houses and households have become the primary context to examine the everyday practices, experiences, ideologies,

symbolism and economic and environmental contexts, and to analyse the formation of socio-economic relations and cultural identities at individual and community level.

1.2.2 Households and Communities

There is a broad recognition in archaeological studies of the complex relationships between what people do in the small space of their daily lives and the larger-scale dynamics of social unit whether a family, household, neighbourhood or community (Matthews 2012, 560). As argued by Bradley Parker (2012, 291) 'households are not passive and static entities. Instead they are the loci of actions where personal identities and economic, social and ideological interests of family groups intersect with and shape the trajectory of the communities, conditioning community participation in broader social processes'. Therefore, the analysis of households provides evidence with which not only to examine daily practices and everyday life, but also to study wider social trends and the interplay between individual and communal concerns in any society or community.

Levi-Strauss (1983) by introducing the 'house society' model, stressed the importance of the house as a form of spatial organisation. House members are bound together through their daily work and activities that contribute to the sustenance of the house and its members. According to this view, daily activities constitute both social and economic relationships within and between houses or other groups in the community. As Chesson (2003, 82) claims, drawing on Joyce's arguments (2000, 190), 'viewing social relations as constituted through cooperative actions recognizes contemporary anthropological concerns of agency and practice'.

Within the social archaeology framework, households are identified not only as analytical unit representative of some set of behaviours, but also as the result of social relations and interaction between individuals and larger social forms (e.g. Dobres and Robb 2000; Hendon 2004). According to this view, the study of household production and social relations consists, not only in the examination of household functions, but also in the analysis of practices carried out by humans and material agents, which contribute to shape and embody social identities and roles. In this perspective material form of households needs to be studied as a dialectic relation between material production and social reproduction (Dobres 2000, 126).

Anthropological studies illustrate that within buildings and settlement there is a 'maze of spatial conventions' (Carsten and Hugh-Jones 1994, 4) through which economic and social relationships and organisation are represented and re-negotiated during the life cycle and history of the settlement and each inhabitant (Parker Pearson and Richards 1994; see also Matthews and French 2005). They have demonstrated that architectural forms and spaces,

including buildings design, size, placement, are powerful media through which social relationships are expressed and materialised (Hendon 2004, 276; De Marrais *et al.* 1996). Similarly, architectural materials, as well as floors, occupation surfaces, furniture and artefactual and bioarchaeological remains, create and embody socio-cultural and political settings, boundary and events within buildings and the life histories of the individuals, household and communities associated with them (Matthews 2005a; Matthews *et al.* 2013; La Motta and Schiffer 1999).

Household provides a dialectical framework that permits to analyse a wide range of social processes, such as the definition of social identities and memories through the daily repetition of practices (Hodder 2005; Kujit 2000, Tringham 2000), the creation of engendered activities and relations (e.g. Kent 1990; Meskell 1998; Webb 2002; Bolger 2003), the construction of rituals and symbolisms in the deposition of household material culture, including symbolic closure of buildings (LaMotta and Schiffer 1999; 23-24; Stevanovic 1997; Cessford and Near 2006), the development of social complexity and socio-economic inequalities (Chapman 2007; Knapp 1993). Therefore, the analysis of household contexts allows us to reconstruct complex social dynamics within buildings and settlements, by looking both at the self and at the society at the same time (Souvatzi 2008, 39).

In order to analyse the social practices and relations within households and communities, it is essential to consider the interplays between micro and macro analytical levels (Birch 2013, 7-10; During 2006, 26-31). In this perspective, the application of micromorphology and high resolution geochemical analysis to examine household contexts provides an effective support to analyse buildings and settlement areas and to study spatial and social conventions within them (see Sections 2.3, 2.4, 2.7). The application of multi-scalar approaches, which are based on the integration of field analysis, micro-scale analysis within buildings and settlement areas, and macro-scale analysis of use and concept of buildings and settlement space, contribute to the production of more multi-proxy results with which to interpret and reconstruct the complex social dynamics of households and communities in any geographical and historical context (Matthews 2005a, 2005b; Boivin 2000).

1.2.3 The Built-Environment in Cypriot studies

While the importance of Bronze Age Cyprus as a period of socio-cultural and economic transformations has long been recognised by studies in Cypriot archaeology, the social significance of these changes has, until recently, rarely been considered (Fisher 2007, 35-39). Previous methodological approaches to the analysis of built-environment and architecture of

Bronze Age Cyprus have been principally based on classification and description of architectural forms, building structure and settlement layout. Buildings were considered static entities, and transformations and changes in buildings forms and layout as well as in social structure and organisation were described as uni-linear processes (e.g. Hult 1983; Astrom 1972; Catling 1963; Wright 1992). Before 1990s, studies of ancient Cypriot architecture were descriptive rather than explanatory and were principally focused on chronological consideration and technological aspects of constructions (e.g. Negbi 1986; Hult 1984). In these analyses buildings were mainly examined on the basis of their stylistic and functional attributes, and built environments were identified as static settings, in which socio-political actions occurred, and not as active contributors and facilitators of social actions and relations (Fisher 2014b). Nevertheless, early attempts to analyse the built-environment in social terms have been conducted by Swiny (1989), in his analysis of transformations in buildings shape and household organisation during the prehistoric Cypriot Bronze Age.

As a result of post-processual critiques (Knapp 1985), which emphasized the necessity to move beyond the limitation of functionalist-processual approaches, a growing emphasis in Cypriot archaeology is on social agency and on the role of built environment as active mediator of social relationship (Knapp 2009; Bolger 2003; Webb and Frankel 1995). More recent studies on Cypriot architecture and built environment have shifted the attention from buildings and settlements as standardised socio-cultural entities to households as dynamic agents, which are viewed as the basic socio-economic unit of societies and loci of actions, where personal identities and economic, social and ideological interests are reproduced and negotiated (Frankel and Webb 2012b; Webb 2009; Fisher 2007; 2009a; 2014a; 2014b; Kearns 2011; Manning *et al.* 2014). According to this research direction, households are not only functional units but also places of social relations, which are created through practices and interaction (Fisher 2014a, 400-402; Meskell 1998; Hendon 2004). A growing body of work has considered the gendered approach to the built environment (Webb 2002; Papaconstantinou 2002; Smith 2002). Bolger (2003) in particular applied an agent-centred approach in her analysis of built environment and household in Prehistoric and Protohistoric Cyprus. In her research, space is a critical dimension of gender, and the built environment both shapes and is shaped by the society that produces it (see Fisher 2007, 52-55).

At settlement scale, the analyses conducted by Knapp (e.g. Knapp 2003; Knapp and Ashmore 1999) and Manning (e.g. Manning *et al.* 2006; Manning *et al.* 2014) stress the need of viewing built environments as part of the cultural landscape. They both recognise the importance of Late Cypriot settlements as loci of social action, where identities, roles and statuses were

negotiated and displayed. In their analysis of urban built-environments, both Knapp and Manning, identify urban structures and monumental architecture as active entities, which contribute to the structuration of social life and its reproduction (Knapp 1997; 2009; Manning 1998; Manning *et al.* 2014). In a similar vein, Fisher (2007; 2009a; 2009b; 2011) analyses Late Cypriot urban architecture as the context for socio-political and economic actions. By applying an integrative approach (Fisher 2007) that is based on access analysis and on the examination of geometric, stylistic and symbolic characteristics of the built-space, he examines how buildings structure movement and encounters, and, therefore, play a fundamental role in the organising and routinizing of embodied practice through which the structural properties of social system are produced, reproduced and transformed (Fisher 2014a, 400).

Although several analytical approaches have been applied in studies of Cypriot Prehistoric and Protohistoric architecture, from contextual analysis at household scale, including the examination of architectural materials and building forms and design (e.g. Philokyprou 2013; Thomas 2005; Papacostantinou 2013), the study of formation processes and spatial organisation (e.g. Frankel and Webb 2012b), the analysis of bioarchaeological and artefactual residues (e.g. Reese and Webb 2006; Croft 2006; Hansen 2003; Frankel and Webb 1996; 2006), to larger scale analysis of settlement layout and regional contexts, by using spatial analysis (e.g. Fisher 2007; 2009a; 2009b; 2014a; Kearns 2011), geophysical methods (e.g. Manning *et al.* 2014; Rogers *et al.* 2012; Urban *et al.* 2013; Urban *et al.* 2014) and surveys (Given and Knapp 2003; Given 2003), none of them have applied a deeply integrated approach that incorporates evidence at micro and macro levels and that combine analysis at building and settlement scales in order to provide a multi-scalar analytical framework with which to produce a more reliable data-set to interpret archaeological evidence and to reconstruct socio-cultural and economic dynamics.

In the following section I examine the innovative aspects of the multi-scalar and interdisciplinary approach that I apply in this thesis research. This novel approach is based on the integration of field investigation and macro analysis of architectural forms, buildings and spaces with high resolution analysis of stratigraphic sequences, deposits and materials within buildings and in settlement areas, and fixtures, artefacts and archaeobotanical remains in order to provide diverse multi-proxy data-sets, whit which to examine architectural evidence at different spatial and temporal scales.

1.2.4 Architectural narratives: materials, buildings and social representation

While studies on architecture of Early Bronze Age Cyprus are principally aimed at analysing household organisation and the role of small scale-everyday activities in social action and reproduction, studies on Late Bronze Age Cypriot architecture, are less focused in the analysis of every-day routines and more on larger scale analysis of use and concept of monumental buildings as elite place-making (e.g. Fisher 2007; 2009a), and of spatial organisation of settlement areas and distribution pattern of settlements within regional contexts (Manning *et al.* 2014).

Both the two approaches provided important insights into broad individuals and communities trajectories and socio-cultural and economic dynamics of Bronze Age Cyprus. However, less has been done to integrate smaller-household based analysis and larger-settlement based analysis and apply a more holistic analytical framework, with which to compare evidence from different spatial and temporal contexts. For this reason, one of the aim of this project is to test the application of a multi-scalar methodological approach, which integrates standard field practices, micromorphology and high resolution analysis of architectural materials, surfaces and occupation deposits within buildings, with macro scale analysis of buildings and settlement areas spatial organisation. This multi-scalar and interdisciplinary approach provides an effective framework to produce a wide-range data-set for analysis of architecture and the activities within it, and supports a narrative approach to study the creation and use of architecture and to reconstruct settlement-history from construction and use to the abandonment of the structures. In fact, is only by integrating insights from multiple spatial and temporal scales that it is possible to understand the relationship between long-term processes of social and cultural change and the lived experience of everyday life (Birch 2013, 8; Kuijt 2000; Trigger 1967).

The innovative aspect of this approach is the attention to deposits, surfaces and micro-materials as media that were used to create and define social settings and boundaries and as embodiments of the histories of people and place (Matthews 2012, 183-185). The application of microscopic analysis and the examination of microstratigraphic sequences within buildings and settlement areas contributes to the identification of activity areas and to the interpretation of individual and community practices by examination of traces of surfaces and activities at high-resolution timescales (Boivin 2000; Matthews 2005a, 2005b). The nature and history of individual interior spaces are also analysed by examination of the type, number and form of fixed architectural furniture, semi-fixed architectural elements, including querns and big storage vessels (see Table 6.2, Chapter 6) and portable objects, and integrated with the analysis of archaeobotanical data

recovered by flotation (see Section 6.1). Each of these categories gives important insights about the use of the space analysed and contribute to define socio-cultural choices, identities, roles and relations in the contexts analysed. The agency of objects and materials and the complexity of their interaction with humans can be better understood, if we consider their life histories and biographies (see Stockhammer 2012). For this reason, the data resulting from micro-analyses are examined within the larger contexts of buildings and settlement areas, and are integrated with larger scale analysis, which comprises the study of syntactic, geometric and symbolic aspects of the built space, including building-unit and room placement, orientation, size and shape and location of doorways as access points (Fisher 2007; 2009; Cutting 2003).

This multi-scalar and interdisciplinary approach is applied to the study of Middle Bronze Age Erimi-*Laonin tou Porakou*, which has been selected as good case study, to analyse the transformations in architectural materials, building practices and use and concept of space and to examine the aspects of innovations at household and settlement scale and reconstruct socio-cultural and economic development of the recent Cypriot prehistory, and shed new light on the complex dynamics or Urbanism and complexity during Bronze Age Cyprus (see Chapter 3).

1.3 The 'Urbanisation' phenomenon

Urbanisation is considered the most radical development in human social relations since the transition to agriculture (Stoddart 1999, 908), and it represents a profound and relevant aspect of social, economic and political change (Childe 1950). However, is not possible to reach an all-encompassing definition of the term urbanisation, as there are many forms and it is not necessarily a uni-linear evolutionary process (Iacovou 2005, 17). In certain socio-cultural areas, urban centres were new kinds of settlements that arose abruptly, in other regions they were more likely settlements that gradually grew so large that they became qualitatively as well as quantitatively different (Cowgill 2004, 535; Birch 2013, 2-5). Keswani (1996), by looking at multiple datasets of Late Cypriot urban contexts, argued that it is not possible to analyse the urbanisation phenomenon as a homogenised 'grand narrative'; urbanisation should therefore be viewed from the perspective of the region or territory (van Dommelen 1997, 245). This research focuses on the middle Kouris Valley area, on the southern region of Cyprus, and more specifically it investigates the Middle Bronze Age site of Erimi-*Laonin tou Porakou*, which has been selected as key case-study for examining the development of Urbanism and social complexity in Bronze Age Cyprus (see Chapter 3).

As Fisher (2014b) claims, the definition of 'urbanism' and 'urban centre' is complicated and there is no consensus among archaeologists and even among scholars of contemporary

urbanism. Factors such as large size, a dense aggregation of people, socioeconomic heterogeneity and the performance of specialised functions in relation to their hinterlands are commonly cited as key characteristics of this phenomenon (Kostof 1991, 37; Trigger 2003; 120). Cowgill (2004, 526), in his analysis of origins and development of urbanisation, emphasized the social aspect of this phenomenon and the important role of social identity in the definition of urban centres. According to his definition 'urban centre' is a 'permanent settlement within the larger territory occupied by a society, considered home to a significant number of residents, whose activities, roles, practices and experiences, identities and attitudes differ significantly from those of other members of the society whose identify most closely with rural lands outside such settlement'.

Urbanism is often associated with the term and concept of "state" and frequently employed as interchangeable in describing this phenomenon of change (Adam 1966; Ferguson 1991). In most cases, they are strongly interrelated; nevertheless, they may refer to two different measures of socio-political development. As Osborne (2005, 2) claims in his examination of Mediterranean urbanisation, the formation of urban communities neither requires nor produces 'the state'. State formation depends both on material and social factors, and although a certain population density and degree of nucleation are prerequisites of complex social and political organisation, it is clear that both density and nucleation are independent of any particular form of political organisation. According to Roscoe (1993), population nucleation enables new possibilities and potentials for social, economic and political interaction; such plurality can provide a context where groups beyond kinship linkages may more easily form. In this way, urban centres make possible a whole range of economic, social and political activities, which cannot be managed as effectively in other forms of settlement (Manning *et al.* 2014, 5). Therefore, although demographic growth and nucleation may contribute to the development of new forms of socio-economic relations and organisation, which are identifiable as 'urban', these processes do not necessarily characterise an urban centre (Birch 2013, 10-11). According to studies of social geography, anthropology and archaeology (Bowman and Wilson 2011; Kosse 1994; Blanton 1976; Smith 2009; Childe 1950; Cowgill 2004; Osborne 2005) the phenomenon of urbanisation not only includes the development of urban centres and their demographic expansion; it also comprises the role of the built environment in mediating social relations, the construction of public spaces and structures, the importance of integrative potential of rituals and socio-cultural behaviours, changes in the social means of production and consumption and transformations in interregional interactions, exchanges and networks (Horejs 2014; Knapp 2013a)

An increase in socio-political complexity has been indicated as one of the characteristic trait of the rise of urbanisation (Knapp 1993). Evolutionary research has long been concerned with the origin and development of complex societies and cultures (e.g. Kowalewsky 1990), generally identified with states and chiefdom. More recently, a number of archaeological studies have concluded that many prehistoric cultures previously described as simple or egalitarian in fact were more complex (see Price and Browns 1985). As advocated by Knapp (1993, 88), the concept of emergent social complexity may be viewed as a transitional stage from 'less complex to fully developed complex societies'.

Both Knapp and other scholars working in Near Eastern contexts (e.g. Maschner 1991) identified basic aspects of fully developed social complexity, which may increase or decrease depending upon the society under consideration. These include: 1) specialised/intensified productions; 2) control over/ access to natural resources; 3) demographic growth, centralisation; 4) social ranking/stratification and new social division of labour; 5) regional/interregional exchange systems; 6) external contacts/external demand.

A theoretical problem with the idea of social complexity embedded in social evolutionism is that it denies complexity to household of pre-state and small scale societies, because of the lack of hierarchical structure and relationships (Chapman 2003). However, households as a social entity, incorporates complexity, which is expressed in the interaction between individuals and the dynamic social and material condition in which they exist (Souvatzi 2008, 42). Olszeweski (1991, 324) in discussing the Natufian culture of the Levant argues that all human groups are socially complex, as culture necessitates complex relationships between individuals and between groups. Social differentiation, inequalities, and restricted power, although contribute to characterise hierarchical system of urban society (Adam 1966) are not markers of social complexity. For example, studies of urbanisation in Southern Levant demonstrate how the concept of uniformity, which is mainly expressed in architectural evidence, has a fundamental role in promoting urbanism, by balancing social forces within the urban framework and permitting the execution of large scale projects (Paz 2012; Chesson 2003; Greenberg 2011). Philip (2001) and Chesson (2003) defined this form of complexity as 'corporate power strategy' (Blanton 1994), in which power is shared by several groups or sector, within society.

To analyse and understand the aspects of variations in urbanisation and social complexity it is essential to examine and compare material within a particular historical and cultural sequence (Knapp 1993, 88). Furthermore, I argue that it is important to approach ancient communities holistically and examine how the community was constituted and reproduced through social

relations an interaction, in order to analyse the phenomenon of urbanisation and increasing complexity not only in economic terms but also and principally from a social perspective (see Manning 1993). I selected architectural evidence, as the principle data-set to investigate the role of built environment in structuring social actions and socio-political relationships and I apply an innovative approach based on multi-scalar evidence for analysing and discussing transformations and innovations in architectural materials, forms and use and concept of space at Middle Bronze Age Erimi-*Laonin tou Porakou* in order to shed new light on urbanisation and increasing social complexity at the end of Prehistoric Bronze Age Cyprus.

1.3.1 Urbanisation in Bronze Age Cyprus

The emergence of urban centres in Cyprus is considered a belated event in comparison to surrounding regions of the Eastern Mediterranean (e.g. Iacovou 2005; Keswani 1996; Held 1993). Urbanism in Mesopotamia is dated back at the mid-fourth millennium BC; in Levant and Anatolia fortified urban centres developed in the early third millennium; in the Aegean, the phenomenon of urbanisation emerged at the beginning of the second millennium BC (Joffe 1993; Adam 1966; Legarra Herrero 2016). The late and rapid appearance of urbanisation in Late Bronze Age Cyprus (1650-1100 BC; defined also as Late Cypriot and abbreviated as LC, see Table 1.2), was viewed, in the existing literature, as the result of demographic growth and politico-economic developments through secondary state formation (e.g. Keswani 1993; Peltenburg 1996; Knapp 1997; Negbi 2005). However, as Kowalewsky points out (2013, 203-210), social developments are not mechanical processes; instead they depend on a number of environmental, cultural and economic transformations, which contribute to create new forms of socio-political organisation.

Traditionally it is not until the Late Bronze Age, that a number of socio-cultural and economic transformations appeared in Cypriot society, which culminated in what some scholars indicate as the emergence of state-level socio political organisation (Knapp 1986; 1988; 1990; 1993; Swiny 1989). The development of social complexity, which was initially indicated by Knapp (1986; 1988) as a result of the interplay of trade and external demand of copper, and described as a gradual appearance of emergent power groups by at least 2000 BC (Knapp 1990; 1993), is, according to his recent argument (2013a; 2013b), a punctuated rather than a gradual phenomenon, which is characterised by the emergence of a centralised, hierarchical, socio-political organisation that can be defined as a secondary state (Knapp 2013b, 39-40). The socio-cultural and economic transformations examined by Knapp (1986, 50, Table 2) in his analysis of socio-political complexity on Bronze Age Cyprus and re-stated in his review of Protohistoric Bronze Age Cyprus (Knapp 2013b, 30, Table 2), include social stratification and

a significant increase in the island's population, specialised systems of production and exchange, agricultural intensification due to the introduction of cattle and plough cultivation, the establishment of a local copper industry and major changes in Cypriot built environment, which were materialised in the appearance of monumental ashlar buildings, and of new types of domestic and mortuary architecture (Swiny 1989; Frankel and Webb 2012b; 2006; 1996; Webb 2009; Keswani 1996). Knapp in analysing the aspects of socio-economic complexity during bronze Age Cyprus

There have been a number of attempts to classify Late Cypriot settlements into various types, functions and sizes (Catling 1962; Negbi 1986; Keswani 1993; Knapp 1997; South 2002). Knapp (1997) distinguishes primary urban centres, which were characterised by monumental and multi-purpose structures that served as foci for new socio-economic activities, political relationships and ideological practices, from secondary towns, tertiary sanctuary sites and peripheral agricultural and mining villages. Keswani (1996; 2004) identifies two types of primary sites: the first comprises new foundations and were generally characterised by a heterarchical form of social organisation and no clear evidence of central administrative structures, such as Enkomi, Morphou-*Toumba tou Skourou,* Kition and Hala Sultan Tekke; the second type consists of urban centres that developed in valleys with long settlement histories, where more localised process of nucleation occurred and enabled more centralised administrative systems, as Maroni, Kalavassos and Alassa (Manning *et al*. 2014, 8). Manning *et al.* (2014, 6), presenting an argument about the relationship between urban forms and socio-political organisation, state that 'when we find large urban centres newly laid out on grid system, we can reasonably assume the prior existence and role of a central authority (or authorities) and a state-level context. (…) In contrast, the mere appearance of an initial monumental building at a town does not by itself indicate the pre-existence of a state, although it may represent a place-making constituent towards state-level society'.

Table 1.1 Chronological table of Levantine and Cypriot Bronze Age. After Killebrew A.E., Steiner M. (eds.) 2014, The Oxford Handbook of the Archaeology of the Levant: c. 8000-332 BCE. Oxford University Press, Oxford.

Period	Alternate names		Absolute date	Cypriot chronology
			3900/3700 BCE	
EB I	Proto Urban		3200/3000 BCE	Chalcolithic
EB II			2850/2600 BCE	
EB III			2500/2300 BCE	
IB	MB I	EB IV	2200/1900 BCE	EC (Early Cyprus)
MB I	MB IIA	MB I	1750 BCE	MC I-II (Middle Cyprus)
MB II(e)	MB IIB	MB II		MC III-LC IA (Late Cyprus)
MB II(I)	MB IIC	MB II	1640/1540 BCE	
LB I	LB I	LB I	1400 BCE	LC IB (Late Cyprus)
LB IIA	LB II			LC IIA (Late Cyprus)
LB IIB	LBIII	LB II	1330/1300 BCE	LC IIB-C (Late Cyprus)
LB/IR	IA IA	LB III	1200/1150 BCE	LC III A (Late Cyprus)

Archaeologists working in Cyprus have largely debated about the definition of urbanism in terms of settlement size and population (Swiny 1981; Knapp 1993; 2008; Keswani 2004; Negbi 2005; Manning 1993), and attempted a distinction between the two forms of urban settlement: towns and cities. Nevertheless, quantitative aspects, as size and demographic number, are of secondary importance in the definition of 'what it is urban' (Negbi 2005, 3; Klengel 1990, 3). Late Cypriot urban centres vary in size but their status does not necessarily correspond to their size (see Birch 2013, 7-10). As stressed by Manning *et al*. (2014), what is most important in the analysis of urbanisation phenomenon and in the examination of what urban centres are, is the study of when and how urban settlement and identity developed and begins to structure a society. Fisher (2014b), in analysing the emergence of urbanism on Cyprus, emphasizes the social significance of Late Cypriot urban centres as creations resulting from a process of place-making, by which space was appropriated, defined and turned into a meaningful context for social interaction. This process was conducted at number of levels, from the top-down planning of the streets and fortifications of urban centres by local elites, to the design and construction of neighbourhoods, individual buildings and their constituent spaces, which involved decisions at individual and community levels (Fisher 2014b, 181-185). According to his argument, urban

centres played a significant social role in revolutionising the lives of people that lived in and around them (Fisher 2007; 2009b; 2011).

Table 1.2 Chronological table of Cypriot Bronze Age.

Cultural period	Approximate date	Revised system (Knapp 2004)
Philia Early Cypriot	2500–2300	**Prehistoric Bronze Age PreBA I**
ECI	2400–2150	PreBA II
ECII	2150–2100	PreBA II
ECIII	2100–2000/1950	PreBA II
Middle Cypriot		
MCI	2000/1950–1850	PreBA III
MCII	1850–1750	PreBA III
MCIII	1750–1650	**Protohistoric Bronze Age ProBA I**
Late Cypriot		
LCIA	1650–1550	ProBA I
LCIB	1550–1450	ProBA I
LCIIA	1450–1375	ProBA II
LCIIB	1375–1300	ProBA II
LCIIC	1340/1315–1200	ProBA II
LCIIIA	1200–1100	ProBA III
LCIIIB	1100–1050	ProBA III

Following the same conceptual approaches, this thesis research aims to shed new light into the phenomenon of urbanisation in Cyprus and to examine when and how urban social identity formed, by analysing transformations and innovative aspects of the Cypriot built environment during the Bronze Age. To accomplish so, the study examines Middle Bronze Age Cyprus (also Middle Cypriot or MC), as a formative period of urbanism and complexity, and investigates the phenomenon of urbanisation as a fluid process, during which social identities, roles and relationships were produced, reproduced and negotiated, gradually shaping a new urban identity *(*Manning *et al.* 2014, 7; Fisher 2014b). More specifically I examine the social role of architecture in the formative period of urbanism, by discussing architectural evidence analysed at Middle Bronze Age Erimi-*Laonin tou Porakou* and comparing them with architectural data of other Early, Middle and Late Bronze Age Cypriot sites (see Section 1.5 and Chapter 8).

1.4 A view backwards: increasing complexity in Early-Middle Bronze Cyprus

Prehistoric Bronze Age Cyprus marks a clear break with the earlier Prehistory of Cyprus; this is evident not only in the material culture but also in the social and economic changes associated

with intensified agrarian practices and metallurgical production (Knapp 2013a, 346). The low degree of social complexity and social differentiation that characterised the Middle Chalcolithic Cyprus become more apparent at the beginning of Early Cypriot period and mainly during Middle Cypriot period (Manning 1993, 36). The origins of these innovations in material culture and social settings is still a matter of debate between who argues for an Anatolian migration and technology transfer (e.g. Frankel 2000; 2005; Frankel and Webb 1998; Webb and Frankel 1999; Peltenburg *et al.* 1998; Bolger 2003a; see also Knapp 2008, 104-110) and who supports the idea of internal changes and developments on Cyprus (Manning 1993, 47-48; Peltenburg 1993; Knapp 1994), yet not excluding the movement of goods and ideas and the gradual cultural meeting and mixing, which Knapp defines as 'hybridisation' (Knapp 2008, 110-130; Knapp 2013a, 268-277; Voskos and Knapp 2008).

Knapp (1990; 1993), in analysing the incipient stages of socio-political complexity on Cyprus during the Early and Middle Bronze Age (c. 2400-1700 BC), argued that the increasing intensification of metallurgical and agricultural production enabled emergent power groups to establish pre-eminence, especially in the northern part of the island, and concurred to create new social dynamics of communication, negotiation and interaction (see also Manning 1993). Knapp suggested that these transformations, which culminated in the social complexity of Late Cypriot society, started to emerge during the mid-3rd millennium BC (Knapp 2013b, 20).

Archaeological evidence of Early and Middle Bronze Age settlements, notably Marki-*Alonia* (Frankel and Webb 1996; 2006), Sotira-*Khaminoudia* (Swiny *et al*. 2003) and Alambra-*Mouttes* (Coleman *et al*. 1996), indicate that communities of Prehistoric Bronze Age Cyprus were stable and internally well integrated (Knapp 2013a, 344-345; Knapp 2013b, 27-28). Although these societies were characterised by a household-based organisation, without evidence of hierarchical organisation and centralised production, an increasing social complexity during Prehistoric Bronze Age Cyprus is evident in many aspects of economic and social life. Archaeological evidence indicates that, along with the intensification of agricultural practices and metalworking, other productions became more specialised, including pottery and textile, which suggest significant organisational changes in society and political economy of Prehistoric Bronze Age Cyprus (Knapp 2008, 350; Knapp 2013a, 324). Archaeological data further attest an increasing difference in wealth and prestige competition that become apparent in the mortuary record of new-established extra-mural cemeteries (Keswani 2004, 83), which attests some structural changes in social organisation of Early and Middle Bronze age communities (Knapp 2008, 350; Manning 1993, 45-49; Peltenburg 1993, 20).

Social and economic changes are further attested in the emergence of a transformative built-environment, characterised by the introduction of free-standing structures and multi cellular architecture, by a different spatial and social organisation of households and settlements, which reflect the gradual appearance of more complex social and economic relations during Early and Middle Cypriot, as thoroughly discussed in Chapter 8. The analysis of stratified evidence at Marki-*Alonia*, indicated that the high level of social and economic cooperation between households, which characterise the early phases of the settlement, was replaced during the EC I-II (Phase C) by new social system, based on more complex negotiation of available territories and by an increased household privacy, as indicated by the decreasing size and importance of courtyards, the introduction of controlled access routes and of private entry passages and the development of single entry non courtyard-house (Frankel and Webb 2006b, 299-302). As indicated by Bolger (2003a, 32), evidence for increasing security of surplus, as attested by the numbers of pithoi and bins within buildings of EC-MC settlements, further suggest an increasing level of social complexity and competition as society began to move away from kinship structures.

The analysis of Prehistoric Bronze Age (PreBA) contexts, attests the appearance during the Middle Cypriot period, of settlements characterised by a segregation of domestic and working spaces, as identified at MC I-II Ambelikou-*Aletri* (Webb and Frankel 2013), MC III Kissonerga-*Skalia* (Crewe and Hill 2012), MC Politiko-*Phorades* (Knapp 2003) and MC Erimi-*Laonin tou Porakou* (Bombardieri 2017). The construction of formal work-places or workshops suggests a development towards a supra-household production and 'industrialisation' of productions, which may be viewed as one of the distinctive traits of complex socio-economic systems (Knapp 2013b, 28; Bombardieri 2013). Recent geophysical surveys at MC Alambra-*Mouttes*, (Sneddon 2015) revealed the emergence of new settlement layout and organisation, characterised by different functional areas/neighbourhoods set amid open spaces, as also observed in the earlier Late Cypriot phases at Maroni (Manning *et al.* 2014). These innovative aspects, which characterise the transformative built-environment of Early and particularly Middle Bronze Age Cyprus are analysed in this study, by comparing evidence from MC Erimi-*Laonin tou Porakou* with those from other Early, Middle and Late Bronze Age Cypriot sites, in order to provide new important insights into the formative period of complexity and urbanisation in Cyprus, which is defined in this thesis as Proto-Urbanisation (Fisher 2014a).

1.4.1 The formative process of 'proto-urbanisation'

Urban systems represent a final point in the long-term transformation of human ways of living, and therefore they may include various stages and phases. As claimed by Birch (2013, 1-16), the study of transition from village-based social organisation to urban system involves the examination of how communities organise themselves in larger groups than existed before and how they maintained such an organisation.

As I briefly examined in the previous section, Prehistoric Bronze Age Cyprus, constitutes a transformative social environment, in which new social, cultural and economic relations were established, maintained and negotiated. All these transformations become more evident during the Middle Cypriot period and mostly during its latest phases (MC II-III/LC I, c. 1750-1850/1650 BC; Peltenburg 1993) and are materialised in the gradual emergence of a transformative built-environment. It is in the making of these built environments and their use in daily practice that new social identities were created and reproduced, transforming the household-based society of Early Cyprus into a more complex social system that is typical of Late Cypriot urban centres (Fisher 2014a).

Following the nomenclature adopted by Fisher (2014b), I indicate this formative period of urbanism and increasing complexity in Cyprus as 'proto-urbanisation', which roughly spans from the end of Middle Cypriot until the mature phase of Late Cypriot (MC III-LC II; ca.1750-1340 BC; Fisher 2014b, 188). It is not possible to encompass the variation of proto-urbanisation systems within a single explanatory model, as evolutionary pathways are multiform as well as social, cultural and economic trajectories. Studies on early urbanisation in Near Eastern contexts emphasizes the important role of built-environment in the analysis of this complex phenomenon (e.g. Joffe 1993). In their examination of proto-urban concept, Ben-Shlomo and Garfinkel (2009, 199) stressed the fundamental role of households, as loci of identity formation and socio-cultural innovations. Studies in Cypriot Urbanism have highlighted the need to pay particular attention to the analysis of households and non-elite areas, since these are recognised as fundamental in the examination of development of social and cultural identities and roles (Manning *et al*. 2014, 9; Fisher 2014b).

While evidence from Near Eastern contexts provide a larger set of archaeological data in support of examinations of proto-urban phenomenon (see Greenberg 2002; Ben Shlomo and Garfinkel 2009; Joffe 1993) the analysis of proto-urbanisation in Cyprus is impeded by the relatively limited exposures of MC-LC I sites. As emphasised by Fisher (2014b, 188), 'less than 5 percent of any site has been excavated and even those exposures tend to be fragmented

into discontinuous areas'. Middle Bronze Age Erimi-*Laonin tou Porakou* (MC I-MC III, ca. 1950-1650 BC), offers a good case-study to investigate this topic, as it includes a range of key contexts to analyse social, cultural and economic developments of the recent Cypriot prehistory, and to enhance the analysis and definition of the formative period of urbanism and complexity in Cyprus (Manning *et al.* 2014; Fisher 2014a; Fisher 2014b).

The present research contributes to study the formative process of urbanisation in Cyprus, by exploring aspects of socio-cultural and economic transformation at this Middle Bronze Age site, since, as stressed by studies of urbanism and complexity, it is not possible to reconstruct evolutionary pathways as a 'grand narrative' (e.g Keswani 1996); instead it is fundamental to examine these transformations from the perspective of the region or territory (van Dommelen 1997; During 2006).

1.5 Aims and objectives of the research

This study aims to examine the socio-cultural organisation of Middle Bronze Age Erimi-*Laonin tou Porakou*, as it is a key-site for analysing the formative process of urbanisation in Cyprus. This process, defined in this research as 'proto-urbanisation' developed between the end of Middle Cypriot (1950-1650 BC) and the beginning of Late Cypriot period (1650-1450 BC). Thus far, the limited availability of archaeological evidence, as consequence of the restricted number of Middle Cypriot-Late Cypriot I settlements investigated, has limited the potential to identify and define the socio-cultural characteristics that marked the transition from a village-based society to an urban society.

The aim in this research, therefore, is to shed new light on the phenomenon of urbanisation in Cyprus and explore the concept of 'proto-urbanisation', using an interdisciplinary approach able to combine different analytic techniques in order to examine, from multiple perspective and sets of material evidence, the socio-economic developments and cultural dynamics, characteristic of this phase of transformation.

This debated topic is studied focusing on architectural materials and practices, building forms and surfaces, fixtures, artefacts, archaeobotanical residues, and use and concept of the built-space, as key media for exploring cultural choices, social representation and reproduction (Fisher 2009; Fisher 2014; Robb 2010; Bloch 2010). Social and architectural studies have demonstrated the multiple ways in which built space is both structured by and structures social relations, everyday practices and routines, experience, ideology and economic and environmental context (Matthews 2005, 356; Bourdieu 1977; Parker Pearson and Richards 1994).

Hence, in order to examine the role of architecture in social reproduction and as the context of social actions and interaction this research analyses three study-sets, organised in a logical order from the microscopic analyses of architectural materials and occupation surfaces to the macro analysis of space and architectural forms (Fig. 1.1):

1. The study of architectural materials, manufacture and placement as indicators of:
   - accessibility and selection of natural resources (Damiani *et al*. 2003; Love 2011, 2013a, 2013b; Miriello *et al*. 2011; Nodarou *et al*. 2008);
   - labour organisation and technological specialisation (Chu *et al.* 2007; Carò *et al.* 2008; Emery *et al.* 2007; Goren *et al.* 2008; Karkanas 2007; Philokyprou 2008; 2011, 2012; Regev *et al.* 2010)
   - the structural and social significance of particular building materials and forms (Matthews *et al.* 1997; 2013; Sillar *et al.* 2000, Berge 2000).

2. The study of traces of activities and use of space through:
   - analysis of the type, form and abundance of fixtures, artefacts and archaeobotanical remains within buildings as indicators of continuity and change in use of space and related socio-cultural and economic implications (Milek 2012; La Motta *et al.* 1999; Schiffer 1987)
   - analysis of deposits accumulated within the spatial units as indicator of continuity and change in use of space and roles and relations represented by these (Banerjea *et al.* 2015; Karkanas 2002; Karkanas *et al.* 2009; Macphail *et al.* 1997; Matthews 2005a; 2005b; 2012a; 2012b; Matthews *et al.* 1996; 1997; Vyncke *et al.* 2011).

3. The study of spatial organisation and role of buildings and settlement areas by:
   - integrated analysis of the syntactic, geometric and symbolic properties of the built space (Giddens 1979; Keith 2003; Fisher 2007; 2009; 2014a, 2014b).
   - contextual analysis of the macro and micro-data, resulting from the first two steps of analysis, in the framework of the integrated spatial analysis to study architecture and the built-environment as indicators of increasing socio-economic complexity and urbanisation in Cyprus.

The case-studies comprise an in-depth analysis of Erimi-*Laonin tou Porakou* and a comparative analysis of other earlier, contemporary and later sites in Cyprus to evaluate development in urbanism in Cyprus and the role of Erimi-*Laonin tou Porakou* in this (see Chapter 3).

The first set of analyses comprises the study of architectural materials and technology. The macro-scale analysis conducted in the field through the examination of colour, texture and consistency of deposits analysed is combined with micromorphological analysis of earthen architectural materials, including mud-bricks and roofing structures, and calcite-rich materials, including floor and wall plasters. Micromorphological analysis permits study of composition, mineralogy and technology and it is integrated with Infrared spectroscopy (FTIR) to enhance the characterisation of mineral composition of these architectural materials, and X-Ray Fluorescence Spectrometry (XRF) to examine their elemental composition.

The objectives in the micromorphology, FTIR and XRF analyses on earthen and calcite-rich architectural materials are to study provenance types, procurement strategies and accessibility to natural resources, and to assess if material composition can be used as indicator of social inequality through preferential use of available resources. Micromorphology, FTIR and XRF analyses are also conducted on selected ceramic samples, pertaining to Red Polished Ware (henceforth RPW) and Drab Polished Ware (henceforth DPW) local productions in order to establish comparisons between architectural materials and pottery industries and to enhance the examination of accessibility and procurement strategies. To create a more robust statistical model in support of provenance studies, XRF analysis are further conducted on a range of natural sediments, as listed in Table 5.1 (Miriello *et al.* 2011; Nodarou *et al.* 2008; Matthews *et al.* 2013).

By integrating field analysis with micromorphology, FTIR and XRF analyses the aim is to examine aspects of labour organisation, level of specialisation and technological development in building practices. FTIR spectroscopy of plaster materials, together with micromorphological analysis, permit study of manufacturing processes, and distinction between fired and non-fired lime plasters, and thereby technological specialisation in the development of pyrotechnology. Micromophological, elemental and mineralogical analyses support also the examination of the scale of production and distinction between household and community production, by enabling assessment of possible circulation of standardised practices and recipes in the production of mud-bricks and plaster types (Berna *et al*. 2007; Chu 2008; Regev 2010; Moropoulou *et al.* 2000; Anderson *et al*. 2014; Forget *et al.* 2015). Field examination of tooling marks that were identified on limestone foundation bedrock, are also included in this analytical set to provide further insights into the organisation of labour and technological specialisation at Erimi-*Laonin tou Porakou* (Wright 1992).

A particular focus is applied to a significant group of materials: pigments. These samples are analysed using Scanning Electron Microscope (SEM-EDX) to obtain data on their chemical composition in order to identify a possible relation between the use of paintings (on particular buildings) and significant social and ritual practices (Anderson 2013; Anderson *et al.* 2014; Damiani *et al.* 2003).

The second set of analyses is conducted through a micro-stratigraphic and micromorphological study of the history of significant spaces of the site. This analysis applies macro-scale analysis in the field through descriptions photographs and drawings of stratigraphic sequences and sections and plinths left on the site, in order to characterise and classify depositional sequences within these spaces (Matthews 1995) and to sample blocks for high-resolution micromorphological analysis from representative sequences of surfaces and occupation deposits. The nature and history of individual interior spaces are analysed by examination of the type, number and form of fixed architectural furniture, semi-fixed architectural elements, including querns and big storage vessels (see Table 6.2, Chapter 6) and portable objects, and integrated with the analysis of archaeobotanical data recovered by flotation (see Section 6.1).

From the blocks sampled, I manufactured large resin-impregnated thin-sections in order to combine macro scale analysis with micromorphology analysis. Micromorphological analysis on thin-section enables: examination of pre-depositional, depositional and post-depositional pathways that created and subsequently impacted the surfaces ad occupation deposits; high-resolution analysis of artefactual, bioarchaeological and sedimentary traces of activities; identification of spatial and temporal variations in use and concept of space. Each of these categories gives important insights on the use of spaces analysed and contribute to define socio-cultural identities at Erimi-*Laonin tou Porakou* (Banerjea *et al* 2015; Karkanas 2002; Karkanas *et al.* 2009; Matthews 2005; 2012a, 2012b; Matthews *et al.* 2006, 2013; Schiffer 1987). This is fundamental to reconstruct life-cycles of buildings and open areas in the settlements and to examine the impact of every-day activities and practices in the formation and reproduction of social identities, roles and relations, which can be identified as proto-urban.

The third set of analyses includes the study of architecture through an integrated spatial analysis approach, which combines Access Analysis with the examination of stylistic, geometric and symbolic characteristics of the built space, including building placement, size and shape, location of doorways as access points, occurrence and significance of fixed, semi fixed elements, portable objects (see Section 2.9) in order to study the role and function of

buildings within the built space and to analyse the level of interaction between people and the built space (Hillier and Hanson 1984; Fisher 2007; 2009a; Cutting 2003). This set of analyses includes the study of specific architectural forms such as thresholds, floors and hearth as physical and social boundaries that contributed to the definition of social interaction and reproduction (Fisher 2009; 2014a; Fisher 2014a). Micromorphological data on floors, surfaces and occupation deposits are integrated in this analytical step to enhance the characterisation of spaces analysed and support the examination of built environment as active facilitator of particular social interactions through which identities, roles and statuses were negotiated and displayed (Fisher 2014b).

Aspects of continuity and innovations in architectural materials, forms, use of buildings, including surfaces, fixtures, artefactual and archaeobotanical residues, and concept of settlement spaces, are analysed in order to examine the role of Erimi-*Laonin tou Poarkou* in the proto-urbanisation process. Each of these aspects is discussed presenting analogies and differences between architectural evidence from Middle Bronze age Erimi-*Laonin tou Porakou* and those from representative Early, Middle and Late Bronze age contexts in order to generate new important insights into the formative process of urbanisation and complexity in Bronze Age Cyprus.

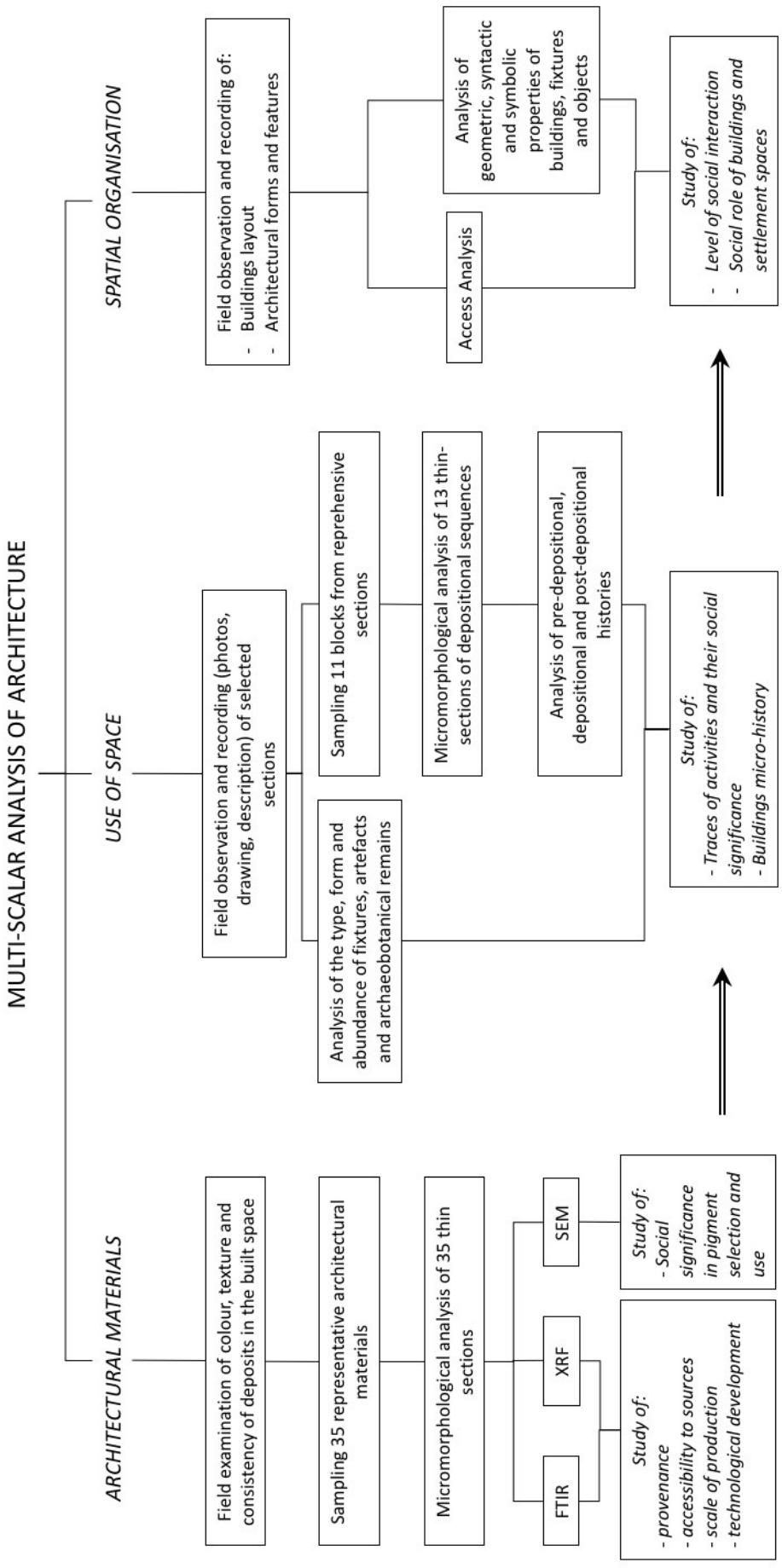


Figure 1.1 Flow diagram summarizing aims and objectives of the research connected with methods.

1.6 Outline of the thesis

In the following chapters I examine the architecture of Middle Bronze Age Cyprus, from the perspective that the built environment plays a direct and active role in the construction and reproduction of social relations and identities. In defining the way architectural materials and design shape and encode meaning and express socio-cultural and economic relationships, I first illustrate the multi-scalar and interdisciplinary approach and methodology that I applied in the analysis of architectural evidence of Middle Bronze Age Erimi-*Laonin tou Porakou* (Chapter 2). More specifically I examine how the dialogue between field practices, laboratory based analyses of materials and deposits, and architectural examination of buildings and settlement areas has been particularly stimulating in the definition of a valid methodological approach both in the Erimi-*Laonin tou Porakou* project and in this thesis. I then evaluate the potential contribution and strengths and limitations of each analytical approach, including field analysis (Section 2.2), micromorphology (Section 2.3), spectroscopic (FTIR; Section 2.4) and geochemical analyses (XRF and SEM; respectively Sections 2.7 and 2.8), and integrated spatial analysis (Section 2.9), in the production of a more multi-proxy and robust data-set with which to interpret and reconstruct socio-cultural transformations and economic developments occurred at the site between the Middle Cypriot period and the very beginning of Late Cypriot period (c. 2100-1950/1650 BC).

In Chapter 3, I discuss the significance of Middle Bronze Age Erimi-*Laonin tou Porakou* and I explain the motivations and rationales in the selection of this site as principal case-study for this thesis project.

Thesis results have been organised in four sections. The first section comprises the classification of components and deposit-types, which were initially identified in the field on the basis on their distinctive macroscopic characteristics and contextual locations, and subsequently refined on the basis of their micromorphological attributes. The aim of this chapter is to outline the main micromorphological attributes of the context analysed, and to reconstruct pre-depositional, depositional and post-depositional pathways of archaeological deposits and materials, as the analysis of site formation processes is central to interpreting the archaeological record (Schiffer 1987; LaMotta and Schiffer 1999).

The second results section, Chapter 5, includes the multi-proxy analysis of architectural materials that were recovered, sampled and preliminary studied in the field and further analysed by integration of micromorphological, spectroscopic and geochemical analyses. The aim is to study architectural materials, manufacture and placement as indicators of technological and

socio-cultural choices in the selection and transformation of materials for architectural surfaces and installations (Matthews *et al*. 2013; Lemonnier 1993; Ingold 2000; Love 2013), and the analysis of the role of architectural materials in the creation of social, cultural and political settings and relationships within buildings and communities associate with them (Matthews 2005; Parker Pearson 1994; Bouridieu 1990; Asatekin 2005). This chapter examines different themes, starting from the analysis of environmental resources and raw materials procurement (Section 5.2) to manufacture practices and techniques of mudbricks and earthen constructional materials, lime-plaster types and stone (Section 5.3). A brief section aimed at analysing post depositional alterations of earthen constructional materials, using FTIR spectroscopy, has been included in this chapter to add to the micromorphological results presented in Section 4.3, in order to support the reconstruction of post-depositional agencies, which caused the destruction of settlement structures (Section 5.4).

The aim of Chapters 6 and 7, is to reconstruct the micro-history of Area A and Area B, respectively the proposed productive and residential areas of the settlement of Erimi-*Laonin tou Porakou*, from construction and use to abandonment of the structures, to analyse how space was used and transformed through time. The analysis of each building comprises the study of the macroscopic architectural data, to examine the syntax and geometric aspects of the built space including building-unit and room placement, orientation, size and shape and location of doorways as access points (Fisher 2007; 2009; Cutting 2003). This is followed by macroscopic and microscopic contextual analysis of construction materials for walls, in order to study possible similarities and differences in material selections and building practices, which may be related to different socio-cultural choices, and roles and representation of buildings (Love 2011; 2012; 2013; Matthews 2005). The nature and history of individual interior spaces are then analysed by examination of the type, number and form of architectural installations, artefacts on floors, followed by and integrated with archaeobotanical data recovered by flotation of the deposits identified in the field within installations and vessels. These integrated data-sets are examined to provide independent interpretations of each interior space according to the architectural elements and artefactual and archaeobotanical data for comparison to macroscopic and microscopic analyses of the floors and occupation sequences. This approach enables greater evaluation of the strengths and weakness of each data-set, the different temporal resolutions that they represent and the potential for integrating and combining them in interdisciplinary multi-scalar analyses of the micro-histories of early settlements.

The wider ecological, social and economic significance of evidence analysed in Chapters 4, 5, 6 and 7 are explored in the discussion Chapter 8. Interpretation and discussion of the evidence

examined are organised according to increasing scales of analysis, from household to settlement level. At household scale the discussion considers aspects of continuity and transformation in the inter-relationship human-environment to analyse individual/communal choices in selection, use and perception of natural materials. Continuity and transformation in technology and manufacture of architectural materials are then analysed, to examine aspects of labour organisation and technological development and related socio-cultural and economic practices (Love 2013a; 2013b; Matthews *et al*. 2013). Finally, performance of buildings, architectural forms and materials are considered to analyse the formation of spatial conventions and how these may influence social actions and reproduction and the development of supra-household socio-economic systems (Boivin 2000; Matthews 2005a; Souvatzi 2008). At settlement scale, aspects of continuity and transformation are examined by analysing changes in settlement layout and variation in role and representation of settlement areas, in order to study possible development in socio-cultural conventions and to examine how the built space was structured and experienced (Cutting 2003; During 2006; Fisher 2007; 2009). The architectural evidence from Middle Bronze age Erimi-*Laonin tou Porakou* is compared to that from representative Early, Middle and Late Bronze age contexts to identify possible aspects of innovations at this Middle Bronze Age site and to generate new insights into the formative process of urbanisation and complexity in Cyprus.

I conclude this study by addressing the research contribution to analytical and theoretical perspectives, and by proposing a number of future directions this research might take in order to expand its scope and more effectively investigate the social aspects of proto-urbanisation process in Cyprus.

2. METHODOLOGY

2.1 Introduction

The formative period of urbanism and increasing complexity in Cyprus, is examined in this thesis focusing on architectural evidence as key media for exploring socio-cultural choices, identities, roles and statuses (Fisher 2009; Fisher 2014; Robb 2010; Bloch 2010). As discussed in Chapter 1 and further examined in Chapter 3, Middle Bronze Age Erimi-*Laonin tou Porakou* has been selected as principal case study for this analysis, as it represents a key-site to investigate the passage from the household-based society of Early Bronze Age Cyprus to the Urban society of Late Bronze Age Cyprus.

The role of architecture in social reproduction and as the context for social action and interaction is analysed in this thesis according to three study sets, which comprise the study of architectural materials as indicator of accessibility and selection to natural resources, technological developments and labour specialisation, and social significance of building materials and forms; the study of spatial and temporal variations in use and concept of space within buildings to analyse the formation of spatial conventions and how these may influence social actions and reproduction and the development of supra-household socio-economic systems; the study of spatial organisation of buildings and settlement areas to analyse the interaction potentials of these contexts and to examine how the built space was structured and experienced, actively contributing to transform, create and reproduce new social identities, roles and relations, as discussed in Section 1.5.

The analytical approach applied to examine the research aims is multi-scalar and interdisciplinary as it combines detailed analysis in the field with geoarchaeological and geochemical analyses of materials and microstratigraphic sequences, and contextual architectural analysis of building forms and concept of space, and the features, artefacts and archaeobotanical remains within these (Fig. 2.1). The dialogue between field practices, laboratory based analyses of materials and deposits, and architectural examination of buildings and lived areas has been particularly stimulating in the definition of a valid methodological approach both in the Erimi-*Laonin tou Porakou* project and in this thesis. This synergy has contributed to definition and compilation of a multi scalar data-set to enable and support the analysis of innovations in architectural materials, technology and social representation at the Middle Bronze age site of Erimi- *Laonin tou Porakou* and to enhance the study of socio-cultural and economic developments of the recent Prehistory-early Protohistory in Cyprus (MCII-III/LC I; 1850-1650/1650-1450 BC).

The application of a multi-scalar analysis at Erimi-*Laonin tou Porakou* responded to the exigencies of developing a holistic approach in the analysis of Cypriot built environments, in order to produce more multi-proxy data-sets with which to interpret and reconstruct socio-cultural transformations and economic developments between the Middle Cypriot period and the very beginning of Late Cypriot period.

The first stage in this analytical approach was conducted in the field, in order to identify and analyse the construction, use and history of contexts in buildings and open spaces. This included recording the spatial and stratigraphic context and sequence of architectural wall, features and artefactual and archaeobotanical remains. Then, stratigraphic sequences were analysed within each context identified, and deposit types were preliminary classified through the recording of distinctive macro characteristics, notably colour, texture and consistency (Fig. 2.1). Representative sections were selected within contexts analysed and blocks for micromorphological analysis were sampled from these sections.

Micromorphology was selected as an approach in order to enable high-resolution distinction of individual strata and microscopic characterisation of specific bioarchaeological, mineral and micro-artefactual components and their attributes and associations within depositional units (Matthews 2005a; 2005b; 2012a). Higher resolution analysis of selected materials and *in situ* micro components and layers were then applied using IR spectroscopy (FTIR), X-Ray fluorescence (XRF), and Scanning Electron Microscopy-Energy Dispersive X-Ray Analysis (SEM-EDX) to analyse a range of geochemical and mineralogical properties of specific components and features (Matthews *et al.* 2013; Anderson 2013; Love 2013a; Shahack-Gross *et al.* 2005; Damiani *et al.* 2003). Cross-referencing with the field observations assisted micromorphological analysis by enabling reflexive examination of the nature, association and significance of micro-attributes of components and deposits in relation to macro-attributes of the space analysed. This step was useful to contextualise and evaluate the microscopic analysis and interpretation of deposits. The methodological approach applied to micro-analysis is examined in the flow diagram, Figure 2.2, where the stages followed for sampling, analysing and interpreting the study-materials are illustrated. Two additional analytical techniques, micro-IR and micro-Raman (in pale grey) were originally scheduled and are included in Fig. 2.2 to highlight their role in the multi-scalar research design, but were subsequently excluded from this thesis research, as consequence of unresolvable laboratory issues (see sections 2.5 and 2.6).

To study the larger scale characteristics of built space at Erimi-*Laonin tou Porakou*, this research then examined the syntactic and topological characteristics of the built space and the

field and laboratory data by integrated analysis of geometric, stylistic and symbolic elements of architectural contexts identified, including building placement, size and shape, location of doorways as access points, occurrence and significance of fixed, semi fixed elements, portable objects and floors and surfaces, and the syntactic relationships between activity areas and spaces (see section 2.9; Hillier and Hanson 1984; Fisher 2007; 2009a; Cutting 2003). The analytical techniques applied in this interdisciplinary and multi-scalar research are illustrated in Figure 2.1 and summarised in Table 2.1. In the following sections I provide a thorough discussion of each of these analytical techniques by examining field methods in Section 2.2, including examination of excavation practices, archaeological data and stratigraphic description, and discussion of sampling strategy. Micromorphology, FTIR, XRF, SEM analyses, and Spatial analysis are examined in sections 2.3, 2.4, 2.7, 2.8, 2.9 respectively. In each of these sections I first discuss analytical principles and methodology potentials, then I examine specific research aims, finally I explain laboratory processes and analysis. In Sections 2.5 and 2.6 I briefly discuss the role of two additional analytical methods, which were originally scheduled and subsequently excluded from this thesis research, as consequence of unresolvable laboratory issues: micro-IR and micro-Raman.

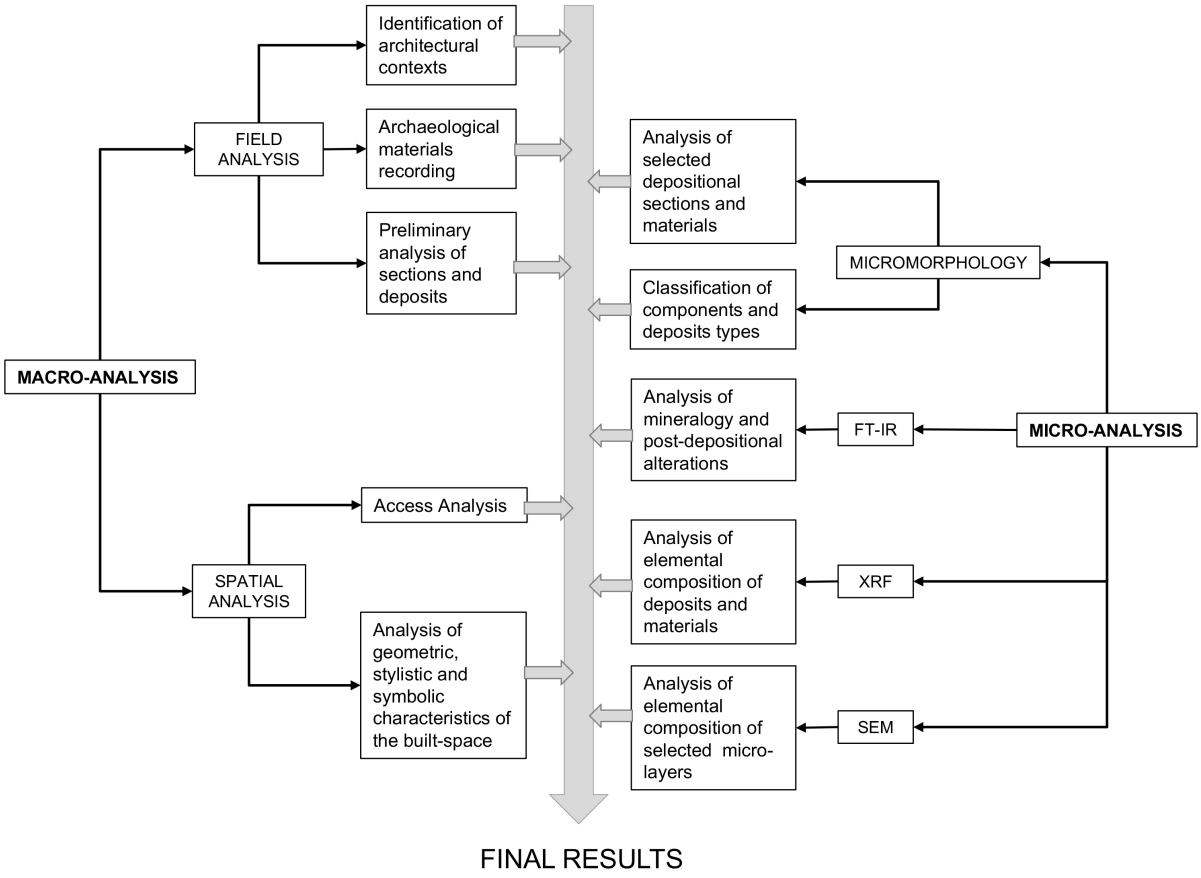


Figure 2.1 Schematic graph illustrating the integration of macro and micro analyses applied to the research.

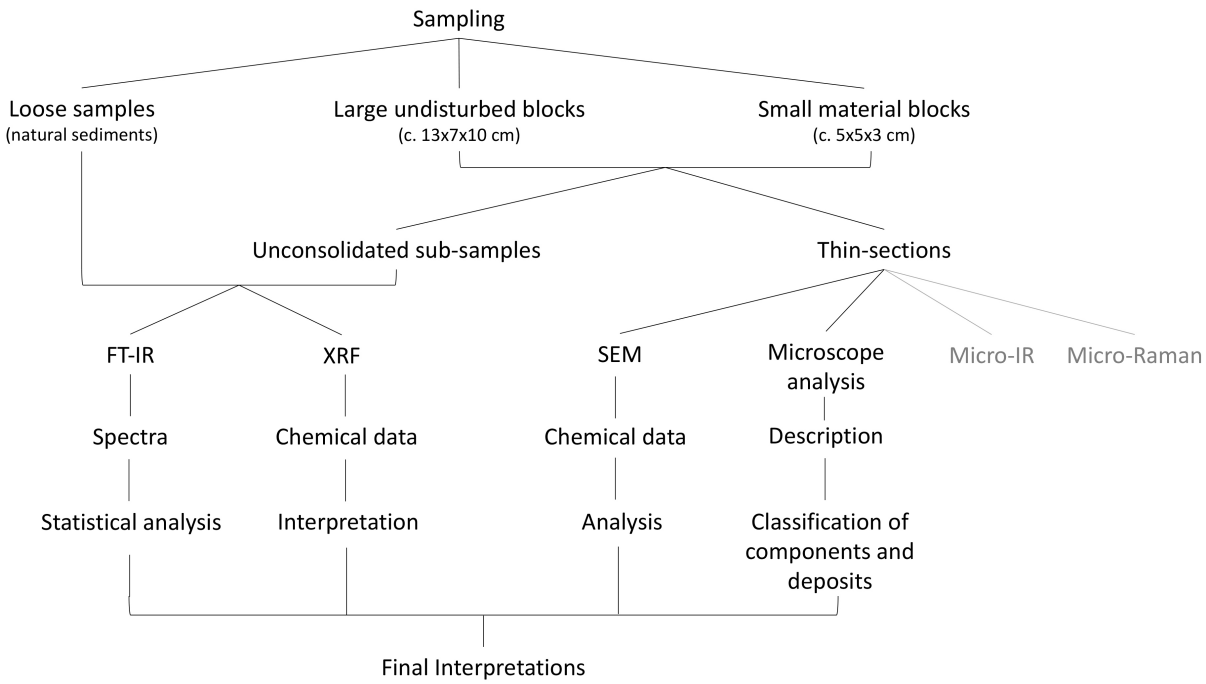


Figure 2.2 Flow diagram illustrating the methodological approach to micro-analyses, from sampling to final interpretations.

Table 2.1 Analytical techniques used in this research and specific aims for each of the individual techniques applied.

Analytical type	Technique	Sample Type	Application to archaeological samples	Aims in analysis
Macroscopic	Field analysis			- To identify and analyse the construction, use and history of contexts. - To develop and test an accurate sampling strategy
Microscopic	Micromorphology	Thin-sections	Optical analysis at magnification of X40-X400	- To study materials and technology of floors, surfaces and occupation deposits. - To study the impact and residues of activities on floors and surfaces. - To study taphonomic processes and post-depositional alterations.
Elemental	X-ray Fluorescence (XRF)	Spot samples	Elemental Composition of samples	- To study provenance of architectural materials. - To study accessibility to local/regional resources.
Mineralogical	IR spectroscopy (FTIR)	Spot samples	Identification of mineral components	- To study technological developments (e.g. pyrotechnology). - To study post-depositional alterations (e.g. effects of exposure to fire).
Microscopy/ Elemental	Scanning Electron Microscopy Energy Dispersive X-Ray Analysis (SEM-EDX)	Thin-sections	Analysis of elemental composition with high resolution (1μm or better)	- To study composition and provenance of micro layers e.g. paints. - To study social significance of art work and use of colours.
Macroscopic	Spatial analysis	Buildings/ Architectural forms	Analysis of syntactic and geometric properties of the built space.	- To study the built environment as context for social interaction and reproduction

2.2 Field methods

2.2.1 Excavation practices

In order to provide links between field and laboratory analyses and to aid interpretation of deposits during ongoing and future examinations, the two areas A and B of the settlement were investigated using open-area excavation techniques in order to examine the horizontal layout of settlement areas. Through this thesis research, we introduced the practice of leaving sections and plinths for vertical profiling in order to integrate study of both horizontal (spatial) and vertical (temporal) variation in floors and occupation deposits (Matthews and French 2005). This combined stratigraphic and microstratigraphic approach was implemented in fieldwork season 2014 and was applied to the study of building-unit SA VI, in Area A.

Deposits were excavated and documented following standard excavation procedures. The field sections were tagged with excavation unit numbers to enable correlation of field, flotation, dry screening, microscopic, archaeobotanical and radiocarbon analyses. The major finds were collected with attention to their precise spatial and stratigraphic context.

2.2.2 Archaeological data

Analysis conducted in the field provided examination of: mapping and recording of archaeological data, including ceramics, stone tools, metals as well as archaeobotanical residues. Field analysis of these materials were conducted by recording their exact spatial and stratigraphic context. Dedicated analyses of these materials were conducted by specialists collaborating with the project (see Bombardieri 2017). Data resulting from these analyses were included in this thesis under licence from the Project director and provided an important and effective data-set for comparison to the new micromorphological and spatial analyses in examination of buildings activities and concept of space (see section 6.1).

Constructive dialogues between interdisciplinary specialists from different disciplines applied to the study of Erimi-*Laonin tou Porakou*, including ceramic analysis, micromorphology, archaeobotany, and radiocarbon analysis, permitted us to develop an effective field strategy, based on systematic and precise sampling, that was designed to obtain diverse multi-scalar and multi-proxy data on the contexts and samples selected, and to cross-reference field and laboratory-based results, providing more robust data-set to analyse and interpret the buildings and open-spaces (see Scirè-Calabrisotto, Amadio *et al.* forthcoming; Bombardieri 2017).

2.2.3 Context selection

The aim in selecting field sections and samples for higher resolution, micromorphological and geochemical analysis was to characterise a representative range of architectural and building contexts and deposit types to inform wider study of settlement and proto-urbanism. Plinths and representative sections were left within each building investigated in this thesis, as reported in Table 2.2. The absence of preserved stratigraphic sequences in open areas, limited the study of these contexts at higher resolution (section 6.2).

Table 2.2 Plinths and representative sections targeted for sampling within each context analysed

Building-unit	Targeted sections
SA I, Area A	1
SA II, Area A	2
SA III, Area A	2
SA VI, Area A	4
Unit 2, Area B	1

2.2.4 Stratigraphic description

The main descriptive criteria used in the analysis of stratigraphic sections in the field were colour, texture and thickness and orientation of stratigraphic units. Sections targeted for micromorphological sampling were examined and described according to field guide, developed by W. Matthews (see Appendix A; Courty *et al.* 1989; Matthews 1992). Each of the vertical sections was then photographed and drawn at 1:5. Section drawings were successively digitalised using Inkscape vector graphics software.

2.2.5 Sampling strategy

Sampling strategy for this thesis was designed to obtain diversity of deposits and contexts types. Sample collection was conducted during the fieldwork campaigns in July-August 2013 and 2014. In total, 11 undisturbed micromorphological blocks were collected from representative sections, through features, walls, floors and occupation deposits. In addition, 35 blocks of earthen and clay materials were selected to compare use of earthen material in architecture with those in other artefacts. These included blocks from; 1) representative architectural materials including wall mud-bricks and earthen wall plaster from collapsed structures, as these materials are rarely preserved in situ in the shallow deposits at Erimi-*Laonin tou Porakou;* 2) representative structures of features including hearths and basins made of or coated with plaster, including those excavated prior to the thesis; 3) 7 ceramic shards pertaining to Coarse, Red and Drab Polished local productions as comparative materials for provenance and manufacture analyses; 4) 11 natural sediments collected from the surrounding environment (max. distance

5km), including different clay types, as terra-rossa and fusca, and calcite-rich soils, and calcite materials, as marls, and local soft and hard limestone (*havara* and *kafkalla* formation; see also sections 5.1 and 5.2.2), as reference samples of local source materials for the analysis of architectural materials.

Sections selected for micromorphological study were moistened with water and cleaned with a palette knife in order to bring out the sharpness of boundaries between deposits and the nature of inclusions. The dryness of deposits in Cyprus, especially during summer season, makes necessary the practice of wetting sections and documenting them under shadow conditions, in order to enhance the analysis and observation of vertical profiles (Fig.2.3).

Undisturbed blocks of 13 cm high, 6-7 cm wide and 10 cm deep were cut out from stratigraphic sections, using a Swiss knife. This procedure was particularly problematic at Erimi-*Laonin tou Porakou* due to the alternation between hard and compact floor layers and calcareous deposits and softer organic-rich packing/occupation deposits. Each block was wrapped tightly in tissue and tape; identification and orientation details were marked on each sample. Blocks were air dried and subsequently packed in boxes for transport to the laboratories facilities of the University of Reading.

Smaller material blocks of 5 x 5 x 3 cm were removed from selected structures and deposits using a Swiss knife, were wrapped with tissue and tape and subsequently were packed in plastic bags.

Approximately 50g of loose sediment samples were collected to enable enough grams for each geochemical technique applied in this research, as specified in Table 2.3. Loose sediment samples were packed in small plastic bags, with identification and geographical position point marked on the bag.

Table 2.3 Sample volume required for geochemical techniques applied in this research (courtesy of S. Maslim)

Technique	Sample volume required
IR Spectroscopy	5-10mg of dried, ground and homogenised material
XRF	~1-1.5 gram of dried, crushed material
SEM-EDX	Non-destructive

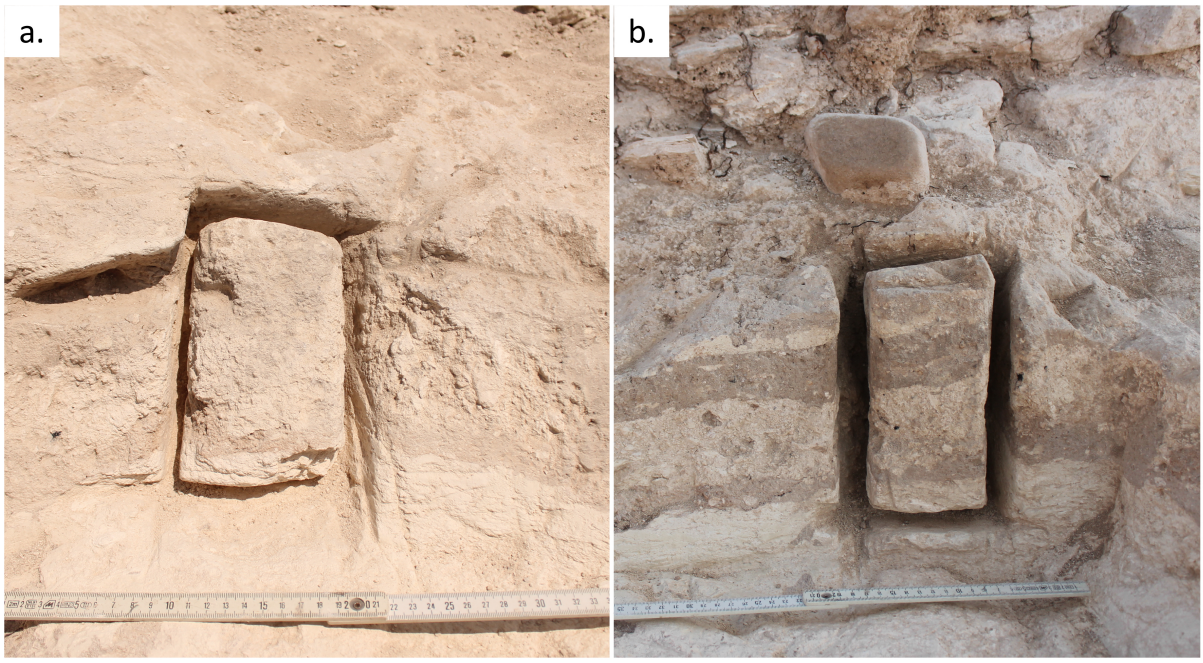


Figure 2.3 Undisturbed block for micromorphology sampled in the northern section of unit SA VI. a) The northern section under normal field conditions; Block KVP14.2 W. Deposits are dry with little visible differentiation. b) The same section under shaded and wetted conditions; Block KVP14.2 E. The depositional sequence is clear, and boundaries between deposits are discernible.

2.3 Micromorphology

Micromorphology is a method of studying undisturbed soil samples with microscopic techniques in order to identify their different constituents and to determine their co-relations in space and time (Stoops 2003, 5). It is a branch of soil science that is concerned with the description, interpretation and the measurement of components, features and fabrics in soils at a microscopic level (Bullock *et al.* 1985, 9).

Micromorphology's principal contribution is that it enables simultaneous high-resolution analysis of the microscopic properties of sediments, artefactual and bioarchaeological remains, within their precise depositional and post-depositional contexts in floors and occupation deposits, which are critical sources of sociocultural and environmental information (Matthews 2005b, 356). Micromorphology enables the analysis of site formation processes and traces of activities by permitting simultaneous analysis of a diverse range of mineral, bioarchaeological and artefactual remains, and their pre-depositional, depositional and post-depositional pathways.

This technique involves the analysis of undisturbed soil samples by means of thin-sections. These comprise microscope slides of resin-impregnated sediments, cut, mounted, ground and polished to 30µm (microns= 1/1000 mm) (Bullock *et al.* 1985, Murphy 1986; Courty *et al.* 1989, Stoops 2003). Thin-sections allow us to observe material components (including

aggregates, voids, mineral grains, anthropic inclusion, post-depositional features, etc.) as they occur in their original setting (Bullock *et al.* 1985, Courty *et al.* 1989). This enables contextual interpretations of assemblages of diverse archaeological micro-remains, which would otherwise be disaggregated and studied as individual categories (Matthews 2005b; 2010; Matthews *et al.* 1997).

Despite these great potentials, micromorphology has also inherent limitations, mainly related to the fact that the sampling process is more frequently selective, and sample size are relatively small, and this can lead to misinterpretation of the study context (Matthews *et al.* 1997, 285; Koromila 2016, 47). Furthermore, the emphasis in analysis is largely on extant visual attributes (Matthews *et al.* 1997, 285; McAnany and Hodder 2009). To overcome these limitations the application of micromorphology in this thesis research and in the Erimi- *Laonin tou Porakou* project, is incorporated into a well-integrated research programme, in order to compare micromophological data with archaeological and stratigraphic analysis conducted in the field, and with larger samples of artefactual and bioarchaeological data from dry-screening and flotation (see also 6.1).

2.3.1 Research aims

In this study, micromorphology is selected as high resolution analytical tool to examine architectural materials, floors, surfaces and occupation deposits within buildings, to analyse artefactual, bioarchaeological and sedimentary traces of activities, and to identify spatial and temporal variation in use and concept of space, and, therefore, to reconstruct life-cycles of buildings and open areas in the settlements, and to study related socio-cultural and economic implications. Furthermore, micromorphology contributes to the analysis of taphonomy and post depositional alterations, enabling more robust reconstruction of site formation processes and settlement micro-history, improving the resulting archaeological interpretations (Matthews 2005a; 2005b; 2010; Karkanas and Goldberg 2007).

Despite the long-established application of micromorphology in the analysis of Near-Eastern and Aegean contexts (Matthews 1995; 2000; 2012a; Boivin 2000; Karkanas and Efstratiou 2009; Karkanas and Van de Moortel 2014) the use of this analytical method in the study of Cypriot settlements is still limited and, excluding a few exceptions, it is not systematically applied as analytical tool in fieldwork investigations. The French expedition at the Pre-Pottery Neolithic site of Klimonas (Vigne *et al.* 2011) is producing interesting data about formation processes and use of space at this site by combining standard field examinations with micromorphological analysis; however, the results produced await final publications.

Micromphological analyses have been also conducted at the Chalcolithic site of Souskiou-*Laona* (Peltenburg *et al.* 2006; Peltenburg 2011) and at the Middle Cypriot site of Kissonerga-*Skalia* (Crewe and Hill 2012) by Matthew Dalton of the University of Cambridge. While in the first case the main publication of the site is still in preparation, in the second case the strong bioturbation of the site area, which is characterised by shallow-stratigraphy, has not permitted collection of systematic micromorphological data (M. Dalton pers. comm.). Micromorphology has been also applied at the Late Bronze age rural site of Arediou-*Vouppes* (Steel 2016; Steel and McCartney 2008; Steel and Thomas 2008) to respond to specific questions concerning formation processes and architectural materials provenance, and a report of micromohological results has been produced by Richard Macphail (2008).

Given the limited availability of micromorphological data in Cyprus, a further aim of this thesis research is to create a reference data-set of components and Deposit-types as well as of pedofeatures and post-depositional processes, which may be used as comparative materials for possible future micromorphological applications in the analysis of other Cypriot contexts.

2.3.2 Laboratory process: thin-section preparation

Thin-section preparation is a long process that involves several stages. Variations do exist among the specific protocols applied in different laboratories. For this study, thin-sections of extra-large (14 x 7 cm), large (11 x 7.5 cm), and small (6 x 3.8 cm) format were produced. Thin-section preparation was conducted at the laboratory facilities of the School of Archaeology, Geography and Environmental Science of University of Reading.

Thirteen extra-large and large thin-sections were prepared following these stages:

1. *Drying*: the blocks were partially unwrapped and left to dry in an oven at c. 40°C. Weight was measured every 24 hours, until weight loss reached values lower than 1%.
2. *Impregnation:* the blocks were placed in foil boxes and then put in vacuum chambers. They were left under vacuum overnight and then impregnated under vacuum with epoxy resin. The impregnated samples were cured in the oven at 70° C for 18 hours.
3. *Cutting*: the impregnated blocks were cut in slices of 1 cm thick, using a diamond-edged saw wheel.
4. *Trimming:* the area of interest was selected and marked on the slices; the area selected was then cut peripherally, using a diamond open saw wheel.
5. *Secondary surface impregnation*: the surface selected for mounting was impregnated a second time to fill any small voids in the resin, and left overnight to cure.

6. *Grinding*: the surfaces of glass slides and the selected samples surfaces were ground flat and polished using a BROT grinder for extra-large slides and samples, and a Logitech-lapping machine for large slides and samples.
7. *Mounting*: The 1 cm thick slices were mounted on a prepared glass slide surfaces with epoxy resin as mounting medium. The sample was left under pressure overnight to harden.
8. *Cutting*: the mounted 1cm slices were cut down to a thickness of c.1mm using a diamond saw wheel.
9. *Polishing*: The 1 mm slices were ground in the BROT grinder and lapped down to a thickness of c. 60-50 μm.
10. *Finishing:* the desired thickness of 30 μm was reached manually for extra-large thin-sections, by using abrasive papers at different grit size, from coarser to finer; large thin-sections were finished using Logitech-lapping machine.
11. *Cover-slipping*: the thin-sections were initially left uncover-slipped in order to apply further micro-analytical techniques. Some of them were subsequently covered by a glass coverslip, using epoxy resin as contact medium, to enhance analysis of phytoliths and their microscopic features.
12. *Cleaning*: Thin-sections were cleaned to remove any traces of resin and labelled.

Small thin-sections were prepared using a slightly different procedure:

1. *Initial cutting*: Samples were cut in blocks with regular shape and standardized size of 3,8x 2,4 cm using a diamond tipped saw lubricated with water. The block surface was flattened using a grinder machine.
2. *Impregnation*: the blocks were placed in foil boxes and then impregnated with epoxy resin. Impregnated blocks were then placed under vacuum to reach a more thorough sample impregnation.
3. *Grinding*: the samples surfaces were ground and polished rotating the impregnated sample face downwards on a glass plate in a mixture of Silicon carbide powder and water. Glass slides were ground flat and polished using a Logitech-lapping machine.
4. *Secondary surface impregnation:* samples surfaces were impregnated a second time in order to fill any small voids in the resin, and left overnight to cure.
5. *Mounting:* The blocks were mounted on a prepared glass slide surfaces with epoxy resin as mounting medium. The sample was left under pressure overnight to harden.
6. *Cutting*: the mounted 1cm slices were cut down to a thickness of c. 1mm, using a diamond saw wheel.

7. *Polishing*: The 1 mm slices were ground in the BROT grinder and lapped down to a thickness of c. 150 μm.
8. *Finishing:* the desired thickness of 30 μm was reached placing samples into the Logitech-lapping machine.
9. *Cover-slipping*: the thin-sections were initially left uncover-slipped in order to apply further micro-analytical techniques. Some of them were subsequently covered by a glass coverslip, using epoxy resin as contact medium.
10. *Cleaning*: Thin-sections were cleaned up to remove any traces of resin and labelled.

During the impregnation and mounting stage, half of the small thin-sections developed major issues. They were difficult to stabilise as possible consequence of macro-porosity of samples matrix. All the processes were repeated two times for half of the samples. A small group of 6 samples required extra care during the surface impregnation stage and were processed for three and four times.

2.3.3 Analysis

2.3.3.1 Instrument

Microscopic examination was conducted using a Leica DMEP standard optical polarising microscope in progressively higher magnifications of x40, x100, x200, x400, in plane polarised light (PPL), cross polarised light (XPL), and oblique incident light (OIL). Microphotographs were taken using a Leica DMEP and DMLP optical polarising microscope with a Leica DFC290 and DFC420 digital camera and Leica Application Suite software.

2.3.3.2 Descriptive criteria and Recording process

Thin-section description was conducted using internationally-standardised procedures and terminology: Bullock *et al.* (1985), Courty *et al.* (1989) and Stoops (2203) were used as guidelines for micromorphological description; Stoops *et al*. (2010) as general reference for the identification and interpretation of components and micro-features; MacKenzie and Adams (1994) and Adam and MacKenzie (1998) for rocks and minerals identification. A wide range of micromorphological, ethnoarchaeological and experimental studies were also used as comparative reference (e.g. Matthews 2005a; Nodarou et al 2008; Friesem *et al.* 2014 for mudbricks and architectural materials description; Canti 2003; 1998; 1999 for ash and spherulites identification). Additional comparative materials were used from the thin-sections reference collection of the University of Reading.

Thin-sections were first analysed macroscopically, with the aid of a magnified scan-imagine. These scans were used to mark boundaries and enumerate single depositional layers and their

correlation with excavation unit numbers. Preliminary characterisation and observations were recorded as text files and enabled preliminary interpretation and classification of deposits.

Subsequently, detailed records and tables of key characteristics of each designed unit was compiled. This stage of recording followed the recording system proposed by W. Matthews in the module of Micromorphology (University of Reading), based on Bullock *et al.* 1985; Courty *et al.* 1989, and Stoops 2003. An example of the recording sheet and the Guide to interpretation of deposit histories are included in Appendix B. The recorded attributes are illustrated in Table 2.4. Full descriptions of individual microstratigraphic units were recorded in an Excel data-base, and are reported in Appendix C.

Table 2.4 Attributes recorded by thin-section analysis, for matrix, inclusions and post-depositional alterations (For description of terms see Bullock *et al.* 1985; Courty *et al*. 1989; Stoops 2003).

ATTRIBUTES RECORDED		
Matrix	**Inclusions**	**Post-depositional alterations**
Thickness	Type	Type
Boundary	Abundance	Abundance
Particle size	Orientation	Orientation
Colour (PPL/XPL)	Distribution	Distribution
Fine material	Shape	Shape
Birefringence	Size	Size
Coarse/fine ratio	Angularity	Colour
Sorting	Colour	
Related distribution	Organic	
Microstructure (voids)	Inorganic	
	Anthropogenic	
	Sediment	
	Rocks	
	Minerals	

Description and interpretation of microstratographic units were conducted through the classification of major component types (see section 4.3). This step was achieved by examining presence and abundance of inclusions in micromorphological units analysed. The abundance of components has been calculated by visual estimation of the percentage of each class of components within single depositional units, by visual comparisons to areas percentage-chart (Bullock *et al.* 1985, Figs. 19.17-19.21; see also Matthews 2005a).

Classification of deposits was aimed at understanding the main deposit characteristics and formation processes in the context study. Several attributes were considered in the analysis and

classification of deposit Types; these are illustrated in Table 4.2. These attributes have been identified as those that are particularly informative in characterising specific Deposit-types and are particularly relevant to the identification of similarities and differences within same categories as well as between different categories of deposits. For example, particle size and sorting enable distinction between the origin and deposition of components (natural water-laid deposits are often well-sorted, anthropic deposits often unsorted), and microstructure and related distribution are informative of manufacture (including pugging and mixing of clay, for example, which often results in an embedded related distribution with few packing voids). Different types of inclusions give indications of procurement areas and technologies in architectural materials, and traces of activities in occupation deposits (Matthews 1996; Goldberg and Macphail 2006). The Deposit-types identified were described according to specific micromorphological characteristics, including colour, particle size, micro-fabric (fine and b-fabric, related distribution, microstructure) and coarse materials/components. The recording of these distinctive characteristics enabled the interpretation and reconstruction of complex pre-depositional, depositional and post-depositional histories of individual units and microstratigraphic sections examined (see section 4.4).

2.4 Infrared analysis: Fourier Transform infrared spectroscopy (FTIR)

Infrared (IR) spectroscopy is a sensitive method for obtaining information of the molecular structures of crystalline, amorphous and organic materials. Therefore, infrared spectroscopy can be used for identifying the mineralogical components of materials and analyse their state of atomic order or disorder (Weiner 2010, 275).

In Infrared spectroscopy analysis, radiations interact with materials into three different regions: near (12800-4000 cm^{-1}), middle (4000-200 cm^{-1}), and far (200-10 cm^{-1}) (Skoog *et al.* 1998). The spectra recorded for archaeological samples are collected in the middle IR region (Anderson 2013, 30). Some of this radiation is absorbed by the sample because it causes the chemical bonds of the sample to vibrate. The result is that less radiation reaches the detector at specific wavenumbers (wavenumber measures the number of cycles a wave undergoes per unit length), and this is recorded as a series of peaks in the infrared absorbance spectrum (Weiner 2010, 275; Smith 2011). The wavenumber at which the peak maximum is located is characteristic of a chemical bond and, therefore, the absorption pecks of a specific material are characteristics of the components of that material. Variation in the shape of a peak or shift to a minor of major wavenumber may be indicative of disorder in the material or small change in its composition.

The advantage of using Infrared spectroscopy is that this technique enables the identification of both crystalline and amorphous minerals, and therefore it represents a valid analytical method for the analysis of a wide range of archaeological samples. In this respect, Infrared spectroscopy offers greater potentials than X-ray diffraction (XRD), as the latter cannot be used to identify and characterise amorphous and highly disordered materials (Weiner 2010, 275). Nevertheless, the interpretation of recorded spectra is often complicated, especially in archaeological materials, which are characterised by different components (Anderson 2013, 33). For this reason, correct analysis and interpretation of spectra require comparisons with reference materials. In this regard, an effective and complete source of comparative spectra for archaeological materials has been developed by S. Weiner of the Kimmel Centre for Archaeological Science of the Weizmann Institute (Israel). A library of spectra is available for downloading at the Web site http://www.weizmann.ac.il/kimmel-arch/infrared-spectra-library.

2.4.1 Research aims

In this research project, Infrared spectroscopy has been selected as the analytical technique to examine the mineralogical composition of a wide range of spot and bulk samples of non-consolidated architectural material samples, including mud-bricks, earthen constructional materials, mortars and plasters, and of selected sub-samples of local ceramic productions, and natural sediments (see Chapter 5). However, the identification of minerals alone may not be enough to characterise plaster and mortar types and distinguish them from limestone parent material, because all of them are formed by calcite. Therefore, infrared analysis has been further applied to distinguish between geogenic calcite in limestone and non-fired plasters, from pyrogenic calcite, which is the result of heated carbonate material in fired- lime-plasters (Regev *et al.* 2010a; Chu *et a*l. 2007), in order to study pyrotechnological processes involved in the production of plaster materials at Erimi-*Laonin tou Porakou*. This application is based on the assumption that calcite has distinctive structural disorder signatures, which are generally higher in anthropogenic/pyrogenic calcite than in geogenic calcite (Xu *et al*. 2015; Regev *et al.* 2010a, 2010b; Chu *et al.* 2007).

Infrared spectroscopy analysis was also conducted to identify possible alterations by exposure to fire in architectural materials, in order to study effects of combustion and post-depositional processes occurred at the site, and their socio-cultural significance (Berna *et al.* 2007; Forget *et al.* 2015).

While Infrared spectroscopy has been largely applied to the study of archaeological materials and sediments in Levantine and Near Eastern contexts, through the scientific contributes offered by scholars of the Weizmann Institute (Regev *et al.* 2010; Berna *et al.* 2007; Forget *et*

al. 2015), the use of this techniques in the study of archaeological materials in Cyprus is still uncommon. Infrared spectroscopic analyses have been principally conducted to characterise painting layers (Nevin *et al.* 2008) and to analyse bone diagenesis in archaeological contexts (Stathopoulou *et al.* 2008). At Erimi-*Laonin tou Porakou*, preliminary spectroscopic analysis has been conducted by the Chemistry Laboratory of the University of Torino (Italy), to examine the composition of plasters and mortars, which were sampled during fieldwork campaigns 2009-2012 and subsequently analysed in 2012 and 2013. The principal contribution of this study was the characterisation of principal aggregates used in the production of plaster materials and the study of pyrotechnology in fired-lime plasters types. In this thesis research, data produced by Turco *et al.* (2016) have been used as reference materials to analyse a wider range of plasters types from building-units SA I, SA IIa and SA IIb, SA III, and SA VI in Area A and Unit2 in Area B (see Table 5.1). In future publications, I will integrate my personal data-set with data produced by Turco et al. (2016) in order to provide comparative reference for future studies in Cyprus and to possibly open new potential avenues into the application of infrared spectroscopy to the study of archaeological Cypriot contexts.

2.4.2 Laboratory process: samples preparation

Sub-samples were selected from architectural materials and micromorphology blocks before they were impregnated with resin (see 2.3.1). For the FTIR analysis in this thesis, a few milligrams of sample were homogenised and powdered with an agate ball planetary mill (Fritsch Pulverisette 5). Calcite-rich materials, including plaster, mortars and limestone, required particular care during grinding. Specific grinding settings, with full width at half maximum (FWHM) values included between 110-130 cm^{-1}, were considered (see Chu *et al.* 2008, 905), as it has been demonstrated that in calcite-rich materials excessive grinding may cause deformation of the atomic structure of the sample (Regev *et al.* 2010).

2.4.3 Analysis

2.4.3.1 Instrument

Analysis were conducted at the Chemical Analysis Facility (CAF) of the University of Reading. IR spectra were recorded using a Perkin-Elmer Spectrum 100 FT-IR spectrometer with an ATR (*Attenuated Total Reflectance*) attachment.

2.4.3.2 Measurement and Spectra Interpretations

The diamond crystal of the Instrument was cleaned with methanol. Then a background spectrum was obtained in order to remove the carbon dioxide peaks at 2,360, 2,342 and 668 cm^{-1}. Samples were placed on the Instrument using a spatula and the pressure arm was applied

and tightened to produce a force of 70 N. The spectrum was recorded between 4000 and 500 cm^{-1} at a resolution of 4 cm^{-1} and 16 repeat scans. The instrument's software automatically subtracted the background. Each sample was measured three times (Chu *et al.* 2007; Berna *et al*. 2007). IR spectra were then processed using Essential-FTIR software (http://www.essentialftir.com) and interpreted using a reference library of infrared spectra of archaeological materials (Weiner 2010), and specific case-studies based on archaeological and experimental materials (Berna *et al.* 2007; Forget *et al.* 2015; Regev *et al*. 2010; Regev 2010; Friesem *et al*. 2014).

2.5 Infrared analysis: Infrared Microscopy (Micro-IR)

Infrared Microscopy is a hybrid of IR spectroscopy and optical microscopy (Anderson 2013, 36). An optical microscope is connected to an Infrared spectrometers in order to obtain infrared spectra from specific areas of the sample. In this way, thin-sections can be analysed for composition of the components that make up the materials (Weiner 2010, 281). Micro-IR analysis were originally scheduled in combination with FTIR analysis (see Fig. 2.1), in order to conduct contextual mineralogical analysis of individual units and selected point on thin-sections as well as for mapping and imaging functional groups across small areas.

Micro-IR analysis were conducted using a *Perkin-Elmer Spectrum 100 FT-IT spectrometer attached to a Spotlight 400 imaging system* of the Chemical Analysis Facility (CAF) at the University of Reading. Initially 10 thin-sections were examined but after recording the spectra, it became apparent that the instrument was malfunctioning. As consequence of this serious issue, the instruments underwent major repairs, which precluded the conduction of analysis for almost 2 years. Consequently, micro-IR analysis were excluded from the project. However, selected thin-sections were left uncover-slipped in order to enable future IR-analysis, whose results will integrate the data-set produced for this thesis research.

2.6 Micro-Raman spectroscopy

Micro-Raman spectroscopy is used for identifying minerals. The technique has the advantage of being non-destructive, as analysis are conducted on thin-sections. Raman spectra are obtained through a specially adapted microscope, which enables the detection of contextual measurement in micro-areas and micro-layers of samples selected (Weiner 2010, 72; Bell. *et al.* 1997).

As a result, Micro-Raman was originally included in this research to analyse selected micro-layers of red-painting, which were identified through micromorphological analysis on the

external surface of two samples of earthen wall plaster. The aim was to integrate SEM elemental analysis of these painting micro-layers (see section 2.8), and to obtain more reliable result on natural pigments selected (see section 2.8.1). Micro-Raman analysis permits collection of spectra of paint layers, and consequently allows us to differentiate and identify natural pigments used. Compared with other similar techniques, Micro-Raman analysis has significant advantages, particularly with respect to analysis time, sensitivity, spatial resolution and immunity to interference (Bikiaris *et al.* 1999). However, major microscope issues with *Renishaw inVia Dispersive Raman Microscope* equipped with a laser sources at 785, 633, 532 nm (Chemical Analysis Facility, University of Reading) impeded the detection of spectra on selected micro-layers, and excluded Micro-Raman analysis from this thesis research.

2.7 X- Ray analysis: X-ray Fluorescence Spectrometry (XRF)

X-ray Fluorescence Spectrometry is an analytical technique used to both identify and quantify the elemental composition of materials analysed.

The technique is based on the principle of fluorescent radiation. When a sample is placed in a beam of X-rays, some of the X-rays are absorbed. The absorbing atoms become excited and emit X-ray of characteristic wavelength. Since the wavelength (energy) of the fluorescence is characteristic of the element being excited, measurement of this wavelength enables identification of the fluorescing element. The intensity of the fluorescence is related to the concentration of that element in the sample (Robinson et. al. 2005).

In archaeological contexts, this technique is largely applied to examine materials provenance; however, XRF is also used in geochemical analysis aimed at detecting the impact of anthropogenic activities on the landscape and to reconstruct activity areas and use of space (e.g. Costa *et al.* 2013; Gauss *et al.* 2013; Hjulstrom and Isaksson 2009). In provenance studies, XRF analysis is used to determine chemical fingerprint of samples analysed and to identify possible correspondence in the chemical composition between archaeological materials (e.g. ceramic and mud-bricks) and raw sources used in their manufacture (Adan-Bayewits et al. 1999; Bonnizzoni *et al.* 2013).

The application of XRF analysis to the study of archaeological materials offers many advantages. First, it is a technique that requires minimal preparation. Many samples can be examined with little pre-treatment. Second, X-ray spectrometry enables chemical composition to be detected in seconds. Analytical instruments are easy to use as analyses are operated through specific software, which handles measurements and result calculations (Shackley

2011, 8-9). Furthermore, XRF analysis is relatively low cost, requires only small samples (c. 1-1.5 gr.; see Table 2.5) and is increasingly portable (Schreiner *et al.* 2004). In archaeological contexts, portable instruments (p-XRF) can be operated on-site on *in-situ* materials without sub-sampling, or in the field laboratories. The hand-held instrument can be applied directly on archaeological materials (ceramics, mud-bricks etc.) as well as on the excavation section (Morgenstein and Redmount 2005). Despite the great potentials of this technique, as it is non-destructive, transportable, easy-to-use and fast, p-XRF analysis cannot replace fully-quantitative laboratory-based analysis, as it cannot accurately detect and quantify some lighter elements in archaeological materials and sediments (Hunt and Speakman 2015).

2.7.1 Research aims

In this study, XRF analysis is applied to examine the chemical composition of architectural materials and local sediments in order to complement the results of micromorphological analysis. Whilst it has been applied to assess dynamics related with land use and soil procurement (Goldberg 1979; Nodarou *et al.* 2008), the aim in this research is to identify source materials and the production choices as means to study social representation and communication (Love 2012; 2013a; 2013b; Matthews *et al.* 2013). Multi-elemental analysis is also applied in this thesis to ceramic shards pertaining to local productions in order to examine the chemical fingerprint of these materials and compare them to those of architectural materials and natural sediments.

The aim in combined analysis of architectural materials and local ceramic is to provide new material evidence with which to analyse the organisation of manufacturing activities in these two local industries, to examine how raw materials were selected and used, and to reconstruct socio-cultural dynamics related with accessibility and negotiation of local natural resources (Love 2013b; Sillar and Tite 2000).

XRF analysis are widely applied in Cypriot pottery studies that are aimed at identifying local and imported ceramic materials, at examining scale of production, and addressing wider questions concerning social organisation and economic developments (e.g. Frankel and Webb 2012a; Dikomitou-Eliadou 2014). By contrast, the application of XRF to the study of architectural materials to date is limited to the analyses conducted by M. Philokyprou (1998) for many Neolithic, Chalcolithic and Bronze age Cypriot sites, such as Kirokitia, Kissonerga-*Mosphili*a, Marki-*Alonia*, Maa-*Paleokastro*, Maroni-*Vournes*, Kalavassos-*Ayios Dhimitrios*. Her analyses were aimed at examining chemical and mineralogical composition of mud-bricks, wall and floor plasters, and at analysing, with a diachronic perspective, the development of

manufacturing techniques applied to the production of these architectural materials. The limited data for Cyprus pertaining to architectural materials contrasts with the much larger data-set of pottery and ceramic data. This lack is in part consequence of the sparse preservation of architectural materials, notably mud-bricks, in many Cypriot contexts, due to the perishable nature of non-fired earthen materials and due to natural post-depositional processes related with climatic and edaphic condition of Cyprus environment, which produce a rapid dissolution of these materials (Friesem 2011; Boivin and French 1995). The potential, however, for this and future studies is high (see Chapter 5).

2.7.2 Laboratory process: samples preparation

Sub-samples were selected from architectural materials and micromorphology blocks before they were impregnated with resin (see 2.3.1). They were placed into an oven overnight at 120°C to eliminate excess water. Samples were consecutively grounded into powder with an agate ball planetary mill (Fritsch Pulverisette 5). Then, they were placed into a vacuum press and turned into pellets using boric acid as supporting medium.

2.7.3 Analysis

2.7.3.1 Instrument

Pellets were analysed by a *Philips PW 1480 X-Ray fluorescence spectrometer with a dual anode Sc/Mo 100kV 3kW X-Ray tube*, by Franz Street (X-Ray technician, SAGES Department, University of Reading). The spectrometer was calibrated using a wide range of international reference standards and the samples were measured using Philips X40 analytical software. The instrument software was used to process the results and present the concentration of several different elements. The nominal detection limit of trace elements is 5ppm. The worst case standard error at 3 sigma confidence of the major elements is a nominal of 5% (F. Street pers. comm.). The results comprise values for ten major elements as weight percentage (wt%) and eleven trace elements expressed in parts per million (ppm).

2.7.3.2 Statistical Analysis

Chemical data were recorded on an Excel file (see Appendix D). Data were preliminary evaluated with multivariate statistical analysis using *Minitab 16 software* package to analyse principal components and pattern of similarities among different groups of components in architectural materials, ceramic and natural sediments and to confirm micromorphology classification. Statistical analysis of ternary composition was then conducted by selecting three components (SiO_2-Al_2O_3 - CaO+MgO), using *Trinity* software. Bivariate analyses were

conducted using *Microsoft Excel statistical suite*, to analyse relationships among two selected chemical components (see Chapter 5).

2.8 X-Ray analysis: Environmental Scanning Electron Microscopy with Energy Dispersive X-ray Analysis (ESEM-EDX)

The Scanning Electron Microscope (SEM) is a powerful instrument, which is used to acquire and examine highly magnified images of a sample and/or determine its elemental composition, based on the X-Ray emitted under electron bombardment (Frahm 2014, 6487).

A Scanning Electron Microscope scans the surface of a sample with a high energy, focused beam of electrons to obtain an image of a small area of interest. When an electron collides with the sample, a wide variety of information-bearing signals is produced. Some of these signals are useful for imaging, while others may be used for compositional of microstructural analysis. One imaging signal is the emission of secondary electrons. The energy of these secondary electrons is so low (<50 eV) that only those emitted by atoms at or near the surface of the sample reach the detector; for this reason, this is a surface analytical technique (Anderson 2013; 53). SEM outfitted with energy-dispersive spectrometers (EDS or EDX) are used to perform multi-elemental analysis of a microscopic portion of a sample. Because the incident electron beam can generate X-rays that are diagnostic of the material under the electron beam, one can obtain a quantitative analysis of the major and minor elements present in sample analysed (Frahm 2014, 6488).

SEM is one of the most versatile analytical techniques in archaeology, applicable to the study of a wide range of inorganic and organic artefacts and archaeological materials. Its utility for archaeological studies is due the facility of the SEM to provide a sharp image with pronounced shadows, producing a distinctly three-dimensional aspect. By contrast, optical microscopes have a flat focal plane and therefore, any part of the object extending above or below this plane is out of focus and the thickness of this plane diminishes rapidly with increasing magnification (Price and Burton 2011, 77-78). This characteristic makes SEM superior to optical microscopy for analysing and identifying microscopic features (e.g. grains, seeds, spores, as well as marks made by tools). Another aspect of the SEM of great utility to archaeologists is its capability to perform multi-elemental analysis of a selected area of a sample. Of relevance to this research, SEM has been applied to the study of: painting layers, to identify and characterise natural pigment selected and used (e.g. Damiani *et al*. 2003; Anderson *et al*. 2014a; 2014b); archaeological deposits, such as middens, to characterise constitutive components, micro-features and micro-layers (e.g. Shillito *et al.* 2009); and ceramic shards, to identify surface

treatments and to conduct micro-chemical analysis of clay and tempers (e.g. Ionescu *et al.* 2015; Ownby *et al.* 2004).

2.8.1 Research aims

Elemental analysis using SEM-EDX were applied to the study of red painting micro layers, which were identified on the external surface of two wall plaster samples, by micromorphological analysis. The principal aim is to analyse the elemental composition of these micro-painting layers and to identify the natural pigments used; more specifically the application of SEM is aimed at distinguishing between red-ochre, umber and terra-rossa pigment naturally occurring in Cyprus, within the sedimentary deposits containing iron-rich sediments. Micro-Raman analysis were initially scheduled (see section 2.6), to support SEM analysis and to obtain more reliable data about the local pigments selected and used (Anderson 2014a; 2014b).

Dr. Emma Anderson (2013) in her University of Reading PhD research on painting layers from the Neolithic site of Çatalhöyük, conducted SEM-EDX analysis on pigment samples in thin-sections, to identify the source materials of pigments previously detected using optical polarising microscopy (Matthews 2005; Matthews *et al.* 1996). Through the innovative potential of conducting chemical analysis directly on thin-sections, it is possible to analyse individual painting layers, without contamination from the adjacent layers of plaster (Anderson *et al.* 2014b, 374).

2.8.2 Laboratory process: samples preparation

To obtain high quality images and analysis, SEM samples need to be electronically conductive (Anderson 2013, 54). Therefore, samples are generally coated with a conductive material, such as gold or graphite. However, thin-sections cannot be damaged and need to be kept intact for future analysis and comparisons. In this respect, the Environmental Scanning Electron Microscope provides an appropriate instrument, as it allows non-destructive analysis without coating, as it operates at low pressure instead of a complete vacuum, which is used in conventional SEM (Anderson 2013, 54).

2.8.3 Analysis

Chemical SEM-EDX analyses were conducted on 7 thin-sections deliberately left uncover-slipped (see table 5.1). The point/area of interest of each thin-section was carefully selected and subsequently a small stick was applied next to the point/area selected to facilitate its identification during the data recording.

2.8.3.1 Instrument

The analyses were conducted at the Electron Microscopy Laboratory (EmLab) of the University of Reading, using a *FEI Quanta FEG 600 Environmental Scanning Electron Microscope (ESEM)* equipped with an Oxford INCA *Energy Dispersive X-ray (EDX) system.*

The thin-sections were positioned in the sample chamber and secured to a moveable stage using adhesive carbon pads. The area of interest was positioned in the centre of the stage before closing the compartment. The magnification was adjusted to focus the beam on the area of interest; then data were collected using the INCA software. The instrument software was then used to determine the chemical elements of the area of interest (Anderson 2013).

Chemical data recorded were used to identify elemental composition of pigments used in the preparation of painting layers, and to compare them to chemical data from reference materials and experimental studies and other known practices in the ancient world (e.g. Costantinou and Govett 1972; Attard-Montalto 2010).

2.9 Spatial analysis

In returning to the macroscopic level, the architectural evidence was examined using 'Space syntax' analysis, based on a conceptual framework and methodology developed by Hillier and Hanson (1984) for the representation, quantification and interpretation of spatial configuration (Fisher 2009a, 440).

Spatial analysis or convex spatial analysis (Hillier and Hanson 1984, 143-155; Hanson 1998, 22-38) is a component of space syntax, and it is used to examine the relationship between spatial configuration and social interaction within a constructed space. Spatial analysis is described in archaeological research as 'Access Analysis'. Access analysis, specifically, is used to record patterns of potential movement in the spatial system analysed and to identify the level of interaction within a certain space (Cutting 2003) and, therefore, provides a way to determine which spaces are more apt to host social interactions (Fisher 2007). This analytical technique involves the representation of built space as a graph and can be applied to the analysis of buildings in order to investigate how each space is integrated with the rest of other spaces in the spatial system and to study social accessibility and control over materials, people and place (Fisher 2007; 2009a). Access analysis is based on the analysis of two spatial units: convex space, which is the enclosed space bounded on all its sides and often represented by rooms or buildings (Fisher 2009a, 440); and the links between convex spaces, which are represented by entrances and doorways.

Access analysis is not only applied as a visual analytical tool but also as a quantitative analytical technique. Quantitative analysis is conducted by calculating syntactic and topological aspects of the numerical relationship between spaces within the spatial system (see section 2.9.2; Cutting 2003, 5).

Despite the great potentials of Access Analysis for the examination of syntactic and topological properties of the built-space, concerns have been raised pertaining to the application of quantitative analysis on prehistoric contexts (Cutting 2003). Typical prehistoric archaeological contexts are unlikely to provide sufficient material to justify the use of access analysis as quantitative methodology, as exposure may be limited and definition of spatial units may be problematic. In fact, it is essential to have reasonably complete plan, with clear entry location to attempt such an application (see also Fisher 2009a, 442). Other scholars have further criticised Access Analysis as it fails to consider the symbolic meanings of the built space, and therefore, while the application of this technique may be effective for the analysis of 'spaces', it has been argued that it is not suited to studying 'places' (Hodder 1991, 39-41; Parker Pearson and Richards 1994; 30). To address these issues Fisher (2007; 2009a, 2009b; 2014a; 2014b; 2014c) developed an integrative approach that combines Access Analysis with a detailed study of how buildings influence human behaviour and interaction through the non-verbal communication of meanings, which are encoded in fixed and semi-fixed architectural elements as doorways, floors, furnishing and other artefacts, as well as in non-fixed features including the physical and verbal expression of buildings users. It is this latter approach that this thesis seeks to explore further.

2.9.1 Research aims

In this study, integrated spatial analysis is applied to the examination of Erimi-*Laonin tou Porakou* built environment in order to determine the interaction potentials and the social and symbolic role of buildings and areas of the settlement.

The construction of Access graph enables the analysis of individual buildings layout, as well as the relationships between groups of buildings and settlement areas, providing an analytical framework to study how buildings structure movements and social relationships (Fisher 2014a, 400). In this thesis, as the fieldwork at the settlement of Erimi-*Laonin tou Porakou* provides evidence of buildings spatial layout and access points, the built-environment is further examined by applying quantitative spatial analysis. However, the data produced cannot be considered conclusive, as the quantitative analysis is applied to an ongoing fieldwork project.

In this thesis, I apply Fisher's integrative approach to combine the study of topological and spatial elements with the examination of geometric, functional and stylistic characteristics of the built space, including building size and shape, doorways placement and type, occurrence of fixed and semi fixed architectural elements and portable objects, as well as the analysis of floors and surfaces. The objective in this integrated approach is to augment the informative potentials of the spatial analysis, by providing an effective analytical framework with which to examine the meaning encoded in buildings and their constitutive elements, through investigating the materiality of the built-space, and analysing how the built-environment configures daily practice, actively facilitating social interactions through which identities, role and statuses are reproduced and negotiated (Fisher 2014a, 400).

While Fisher's analyses were mainly focused on elite, monumental contexts of Late Bronze Age Cyprus (e.g. Enkomi, Alassa-*Paliotaverna*, Kalavassos-*Ayios Dhimitrios;* Fisher 2007; 2009a, 2009b; 2011; 2014c) this study is dedicated to the analysis of a prehistoric context, as discusses in Chapter 3. An innovative aspect in this research is the integration of space-syntax analysis with micro-contextual-data, which provide multi-scalar data-set, with which not only to characterise activities and functions of spaces analysed, but also to examine symbolic meaning and social significance in the selection, construction and use of architectural materials and forms (see Section 1.2.4).

2.9.2 Method

To determine a configurational description of spaces analysed, and to describe the way these spaces are arranged within a system and to calculate the interaction potentials of buildings of the settlement as well as their role and social representation, this research applies space-syntax analysis principles and integrate them with the examination of geometrical, stylistic and symbolic characteristics of the built space.

2.9.2.1 The bounded space

The basic unit of analysis selected in this thesis is the 'bounded space', which is a space defined by physical boundaries such as walls. These spaces are represented in the graph as circles and relations between accessibility of these space are represented by line segments that link the circles (Hillier and Hanson 1984, 104-105). The space outside the building is often classified as the 'carrier' and represented by a circle with a cross and is treated as single space, although in future research there is scope for considering the syntax of activity nodes and pathways within and between open spaces . The carrier is usually taken as the point of origin of the graph, and used as such in this research (Fisher 2009a, 440).

2.9.2.2 Justified access graph

In this research, an access map was produced by creating links between bounded spaces, and justified from the perspective of the carrier position. Justified access graphs provide a visual representation of the relational properties of each space in term of their access to one another. In this justified access graph, each horizontal layer represents different spaces found at the common level of permeation/depth. To justify an access graph, each space was assigned a depth value depending on its distance from the carrier position (Parmington 2011, 36). The depth value was calculated by counting the number of spaces that need to be crossed to arrive to the target space from the point of origin (Hillier and Hanson 1984, 149; Fisher 2009a, 440). This approach was selected to assess the accessibility of a space from the perspective of a social agent and, therefore, to permit determination of those spaces that are more permeable from outside and those that are not.

2.9.2.3 Control Values (CV), Mean Depth (MD) and Relative Asymmetry (RA)

Justified access graph provided a useful platform for the calculation of three variables, which are particularly important for the analysis of social interaction (Hillier and Hanson 1984, 143-175).

The theoretical premises to explain the significance of these variables are that every space has both local relationships with its neighbouring spaces and global relationships with all other spaces in the system (Grahame 1997, 147). The Control value (CV) is a measure of local relation, which permits to calculate the amount of control that a space possesses over access to other neighbouring spaces in the system.

The CV in this research was calculated by assigning the value of 1 to each space, which is equally divided among each of the neighbouring spaces to which it has direct access, and then totalling these for each space (Fisher 2009a, 441). For example, taking unit SA III in Fig. 2.3, we see that this space has two immediate neighbours: unit WA II and the carrier. Unit WA II has two neighbouring unit: WA I and SA III. Therefore, the calculation for unit WA II would be 1:2 = 0,5. The Carrier instead has 5 neighbouring spaces, so 1:5 = 0,2. After a calculation have been made for all neighbouring spaces, the results are added together to give the CV for the space in question (see Parmington 2011): SA III CV value is 0,5+0,2 = 0,7. Any space that has a CV of 1 or greater is considered to be a controlling space, any space with a CV less than one is considered to be a controlled space (Hillier and Hanson 1984).

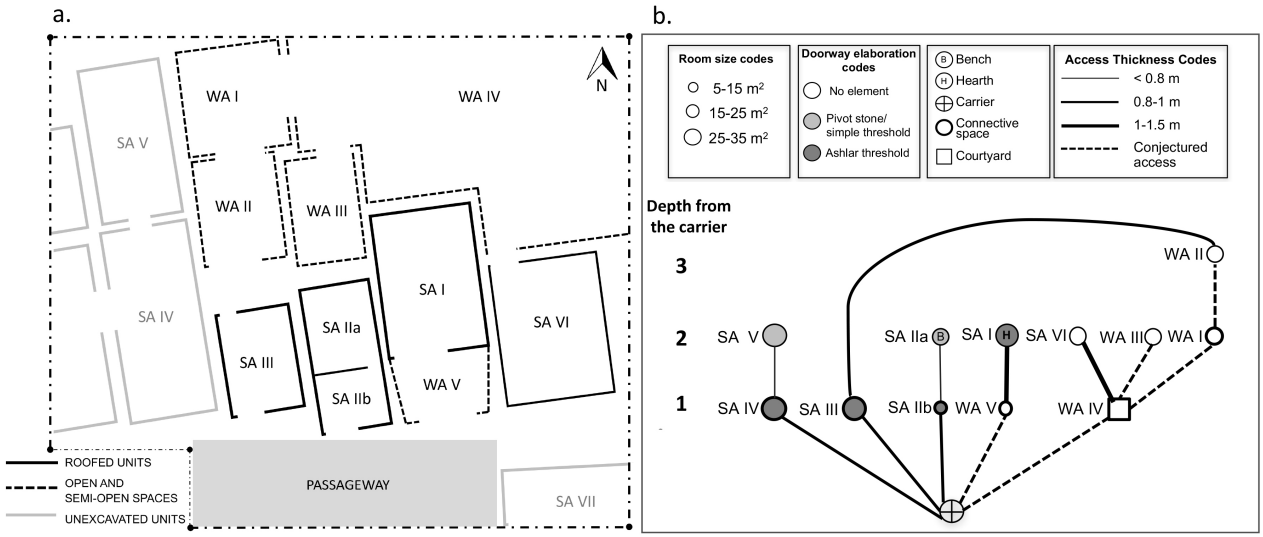


Figure 2.4 a) Schematic plan of Area A at Erimi-*Laonin tou Porakou*; b) Access Graph of Area A, Phase A with integrated symbols and codes.

The method used to analyse the global relationships of a space within a spatial system was through Relative Asymmetry (RA) analysis, which measures how accessible a space is from any other space in the structure, following Fisher 2009a, 441. To calculate the RA value, it was necessary to measure another variable, the Mean Depth (MD), which measures how deep a space is relative to all other spaces in the system. The MD was calculated assigning a score of 1 to every space within the system that necessitates the crossing of one boundary to reach a target space, a score of 2 for those spaces that require the crossing of two boundaries to reach a target space, a score of 3 for those spaces that require the crossing of three boundaries, and so on (Parmington 2011, 39; Hillier and Hanson 1984, 108; Grahame 1995; 148-149). In this thesis, the way of compiling these distance values was to construct a path matrix for the spatial system analysed (Blanton 1994, 34-35). In the path matrix Table 2.5, each depth value represents the minimum number of boundaries that need to be crossed in order to access from one space to another.

Table 2.5 Path matrix for buildings of Area A (see Fig. 2.3 a)

	C	SA I	SA IIa	SA IIb	SA III	SA IV	SA V	SA VI	WA I	WA II	WA III	WA IV	WA V
C	X	2	2	1	1	1	2	2	2	3	2	1	1
SA I	2	X	4	3	3	3	4	4	4	5	4	3	1
SA IIa	2	4	X	1	3	3	4	4	4	5	4	3	3
SA IIb	1	3	1	X	2	2	3	3	3	4	3	2	2
SA III	1	3	3	2	X	2	3	3	3	1	3	2	2
SA IV	1	3	3	2	2	X	1	3	3	4	3	3	2
SA V	2	4	4	3	3	1	X	4	4	5	4	3	3
SA VI	2	4	4	3	3	3	4	X	2	3	2	1	2
WA I	2	4	4	3	3	3	4	2	X	1	2	1	2
WA II	3	5	5	4	1	4	5	3	1	X	3	2	3
WA III	2	4	4	3	3	3	4	2	2	3	X	1	2
WA IV	1	3	3	2	2	3	3	1	1	2	1	X	1
WA V	1	1	3	2	2	2	3	2	2	3	2	1	X

As an example, to calculate the MD value of unit SA I, we added together all spaces found at common depth and then multiplied these totals by their corresponding depth values. For column SA I we counted 1 space at a depth of 2 (the carrier); five spaces at a depth of 4 (SA IIa, SA V, SA VI, WA I, WA III); four spaces at a depth of 3 (SA IIb, SA III, SA IV, WA IV); one space at a depth of 1 (WA V); one space at a depth of 5 (WA II): 1x2 = 2; 5x4 = 20; 4x3 = 12; 1x1 = 1; 1x5 = 5. The totals were then added together and divided by the total number of spaces in the system, less the carrier. Therefore:

$$MD = \sum d_k / k - 1,$$

where $\sum d_k$ is the sum of the depth values for each of the *k* spaces; *k* is the number of spaces in the configuration (Grahame 1997, 149). As SA I is part of a spatial system that comprises 13 spaces including the carrier, the MD of unit SA I will be as follow: 40/ 13-1 = 3,333.

After the MD of each space in the system was calculated, the RA value can be measured using the following formula:

$$RA = 2 (MD-1) / k-2$$

Therefore, the RA value for Unit SA I is: 2 (3,33 – 1)/ 13-2 = 0,418. The resulting RA value will be a number between 0 and 1. A lower value indicates that the space is easily accessible and well integrated within the spatial system, a higher value indicates less accessibility or integration (Hillier and Hanson 1984, 108-109; Fisher 2009a, 441; Parmington 2011, 40).

After the CV, MD and RA values were calculated, they were ranked (see Fisher 2009a, Table 3) to examine the gradient of integration for all spatial units represented.

CV and RA variables were visualised in the Access graph using different symbols (see Access Thickness Code in Fig 6.3, Chapter 6). The combination of these data is essential to determine which space are most significant in structuring movement and interaction within a certain area (Fisher 2009a, 442).

2.9.2.4 Geometrical, stylistic and symbolic elements

Access analysis was integrated with the study of geometrical elements of the built space and with the examination of stylistic and symbolic characteristic of architectural forms, as these play an important role in shaping social interaction and contribute to characterise the space analysed (Fisher 2009a, 442-443; Altman 1975; Boast 1987, 452-454).

The elements and characteristics analysed are:

- *Buildings shape and size*, as these are important factors in determining the types of interaction that can occur within a certain space. The shape of a space was measured calculating the *Relative convexity*, which was determined by dividing the width of a space by its length (Grahame 2000, 56-57). Relative convexity is a measure of the 'squareness' of a space, since, typically, long narrow corridors promote different types of interactions than large square spaces (Fisher 2009a, 444). A result of 1 indicates a perfect square, while values around zero indicate an increasingly long, rectangular space. The size of building, which are measured in m^2, was compared in an integrated graph using a Room size code (Fig. 6.3, Chapter 6)

- *Doorways width, placement and type*. Doorways width and placement are important indicators of the type of movement between a space and the other. The architectural characteristics of a doorway are also significant as they mark the functional and symbolic role of building/room. In this thesis, the material as well as the stylistic characteristics of doorways are also considered. These are included in the Access graph using a 'Doorway elaboration score' (see Fig. 2.4 b and Fig. 6.3, Chapter 6).
- *Fixed and semi-fixed elements and portable objects.* Fixed and semi-fixed architectural elements provide important information about use, movement and symbolic meaning attributed to certain activities and spaces by building users. In this thesis, the general characteristics of these elements were recorded, including their dimension, placement and constructional materials. Portable objects are also highly informative about uses and concept of spaces, and therefore are included in the analysis by recording the type and quantity of objects occurring within the space examined.
- *Floors and surfaces* are important indicators of functional as well as representative and symbolic characteristics of the built space. In this thesis micromorphology provides an innovative powerful analytical tool in combination with these spatial analyses, with the aim of contributing to examination of the social use and meaning of buildings and settlement areas analysed (Fishers 2011; Rapoport 1990).

3. THE MIDDLE BRONZE AGE ERIMI-*LAONIN TOU PORAKOU*

Recent studies in Cypriot urbanism have stressed the need of developing multi-scalar data-sets to analyse the history and organisation of urban centres from diachronic, spatial and structural perspectives, and to pay particular attention to the analysis of non-elite areas, since these are recognised as fundamental in the examination of development of social and cultural identities and roles (Manning *et al.* 2014, 9; Fisher 2014b). Middle Bronze Age Erimi-*Laonin tou Porakou* (MC I-MC III, ca. 1950-1650 BC), offers a good case-study to investigate this topic, as it includes a range of key contexts to analyse social, cultural and economic developments of the recent Cypriot prehistory, and to enhance the analysis and definition of the formative period of urbanism and complexity in Cyprus (Manning *et al.* 2014; Fisher 2014a; Fisher 2014b). This section is aimed at introducing the site of Erimi-*Laonin tou Porakou* by explaining the motivations and rationales for its selection as principal case-study for this thesis research.

3.1 Why Erimi-*Laonin tou Porakou*?

The site of Erimi-*Laonin tou Porakou* (henceforth Erimi-LtP) was first identified in 2007 as result of a survey project aimed at outlining the landscape use and sequence of ancient occupation in the middle and lower valley of river Kouris, in the southern region of Cyprus (see Figs. 3.1, 3.2; Bombardieri *et al.* 2009a; 2009b; Bombardieri 2010). Since the first survey season the site area revealed significant material evidence and topographic characteristics, which encouraged further survey investigations in 2008 and intra-site analysis from 2009 to 2014, and 2016 (Bombardieri 2017). Pedestrian surveys in the site area evidenced both a high density of surface materials, corresponding to 5.66 shards per 100 m^2 and 4.90 diagnostic shards per 100 m^2 (Bombardieri and Chelazzi 2015, 125-129) and key topographic attributes, including a prominent position of the settlement on a limestone hill facing the eastern bank of Kouris river, which suggested a possible function as sighting point overlooking the network system of the valley, and favourable natural characteristics including access to water and wood resources (Bombarideri and Chelazzi 2015, 130; Scirè-Calabrisotto *et al.* 2017).

Erimi-LtP has been investigated in greater detail since 2009 by the Italian Archaeological expedition, directed by Dr. Luca Bombardieri of the University of Torino, in close collaboration with the Department of Antiquities of Cyprus (www.erimilaonin.it). Erimi-LtP was constructed on a high limestone hill in the middle valley of Kouris River, with a view over the river valley as well as on the small inner valleys and possibly on the seacoast, as suggested by analysis of visibility parameter through viewshed processing of the Digital Elevation Model

(Bombardieri and Chelazzi 2015). Dedicated fieldwork analysis revealed that the settlement of Erimi-LtP was organised in distinct functional areas, which were constructed on sloping limestone terraces: on the top of the hill the presumed productive Area A, which has been identified as multifunctional workshop principally designed for dyeing and textile activities (Bombardieri 2009a, 2009b; Muti 2016); on the first sloping terraces the presumed domestic Area B; and on the lower southern terraces the funerary Area E (see Figs. 3.3, 3.4).

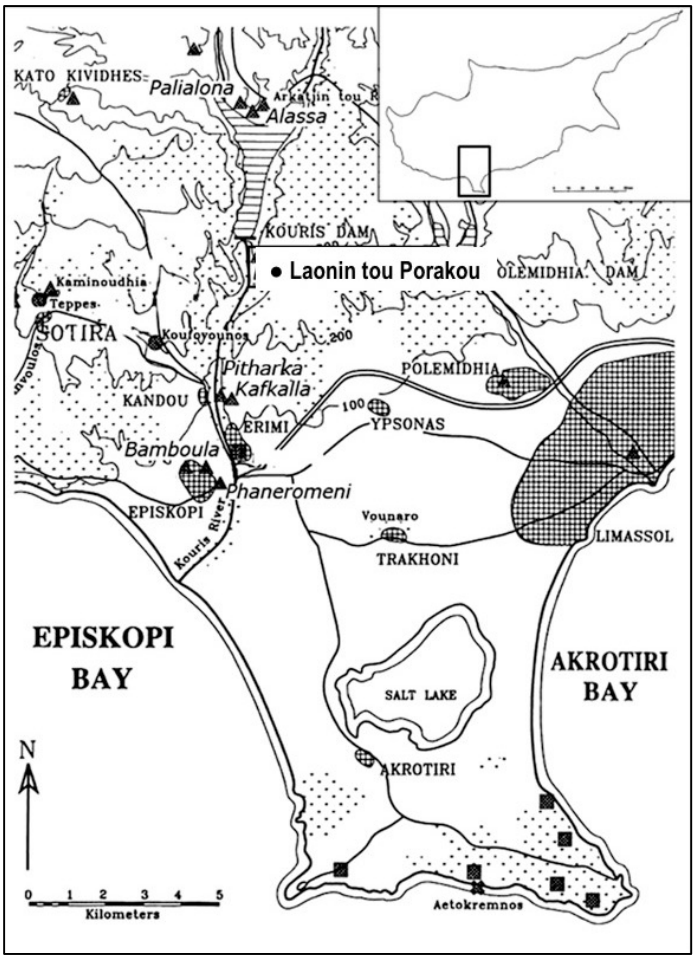


Figure 3.1 Map of the Kouris valley region indicating the position of Erimi-*Laonin tou Porakou* (after Bombardieri 2009a).

Notwithstanding the long history of archaeological research in the Kouris Valley region, which indicates an uninterrupted sequence of occupation since the Neolithic period (e.g. Kandou-*Kouphovounous*; Mantzourani 2003), very little evidence on Middle Bronze Age settlements has been identified, and that available mostly pertains to funerary contexts (e.g. Alassa-*Palioalona*; Fluorentzos 1991). This period, therefore, is still little explored both in regional analysis and more generally in studies of Bronze Age Cyprus. Yet, Middle Bronze Age Cyprus (c. 1950-1650 BC) represents a key-period of Cypriot prehistory to examine the passage from the village-based rural society of Early Cypriot to the urban society of Late Cypriot.

Typological analysis conducted on ceramic assemblages recovered at Erimi-LtP indicated an occupation throughout the Middle Cypriot Period, on the basis of ceramic types, notably Red Polished Ware (hereafter RPW) and Drab Polished Ware (DPW), mostly pertaining to a Middle Cypriot II-III repertoire (Bombardieri *et al.* 2009a). Radiocarbon analysis confirmed ceramic interpretation, by indicating the initial phase of settlement occupation during ECIII-MC (c. 1960 BC) and the abandonment phase before LC IA (c.1650 BC) (Scirè-Calabrisotto 2017; Scire-Calabrisotto *et al.* 2017). Middle Bronze Age Erimi-LtP, therefore, offers a good case-study to analyse socio-cultural and economic trajectories of the recent Cypriot prehistory, and to provide new insights into the formative period of urbanisation in Cyprus.

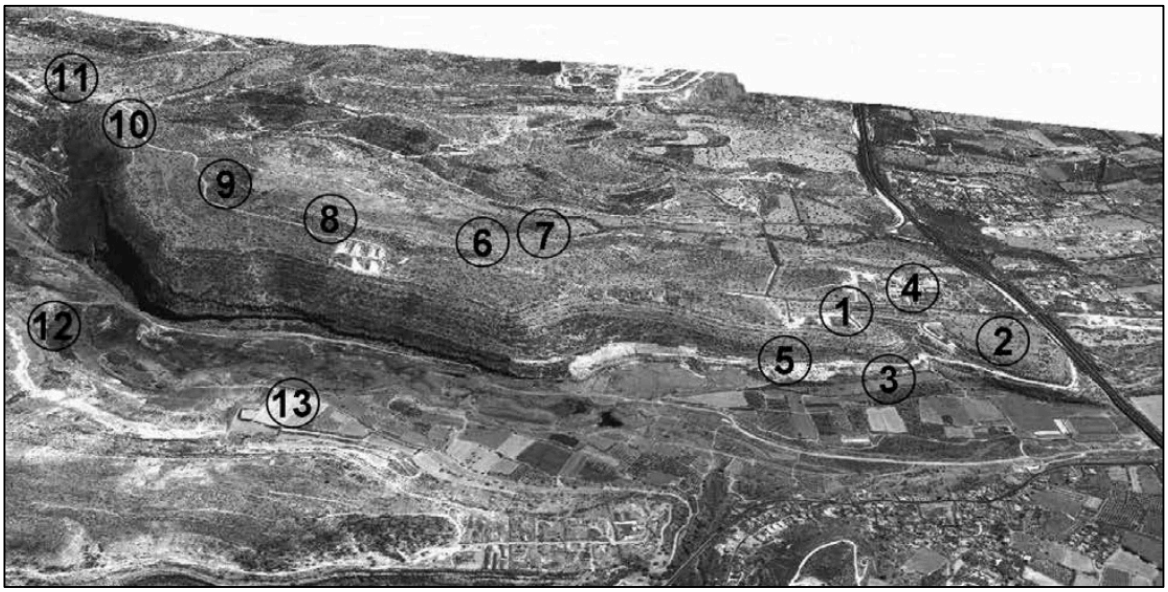


Figure 3.2 Digital Elevation Model indicating the sites identified in the middle and lower valley of Kouris river. Erimi-LtP is the number 10 (after Bombardieri 2017).

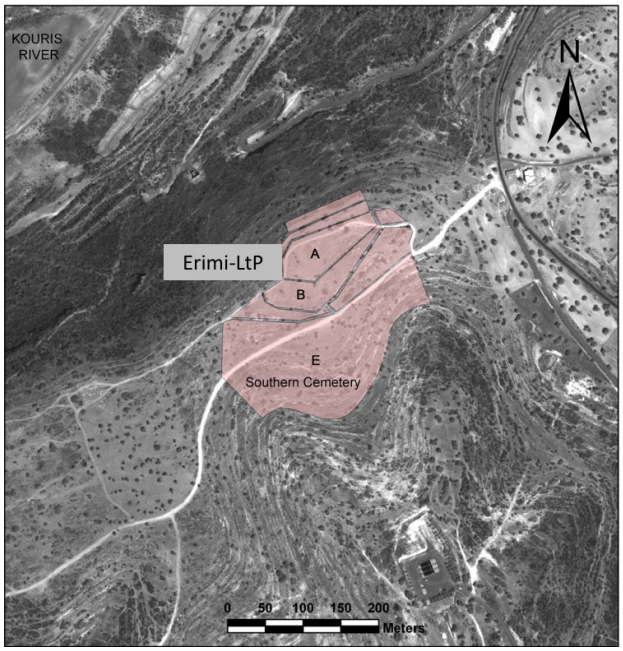


Figure 3.3 The terraced layout of Erimi-LtP settlement (after Bombardieri 2009a)

The good preservation of architectural and stratigraphic evidence was one of the prerequisites for conducting a multi scalar-analysis of architectural materials and forms, buildings and settlement spaces. The earthen architecture of many prehistoric sites, not only in Cyprus but in many areas of the Mediterranean basin, may be affected by post-depositional alterations, which preclude the preservation of structures and materials, thus limiting the potential for examining and interpreting archaeological evidence (see Friesem *et al.* 2011; 2014b). The building technique adopted to construct the settlement of Erimi-LtP, with buildings carved directly into the limestone foundation bedrock and walls built of mudbricks laid on stone footings (see Fig. 4.2 and Chapters 6, 7), contributed to good preservation of building structures, providing key information on the definition of individual spaces and access points and of settlement layout, which are essential elements for the application of spatial analysis in archaeological contexts (Cutting 2003). Despite the shallow stratigraphy of settlement areas and post-depositional alterations (see Section 4.2), depositional sequences within buildings at Erimi-LtP still retained important information, which made possible the application of micromorphological and high resolution analysis of architectural materials, surfaces and occupation deposits.



Figure 3.4 Aerial photo of Erimi-LtP area (Erimi-LtP project archive)

Further important in the selection of Erimi-LtP as case-study was the possibility to apply an interdisciplinary and multi-scalar analysis of architectural evidence on an ongoing project. The opportunity to work at the site as field supervisor and micromorphology specialist, enabled me to acquire and combine macro and micro stratigraphic evidence, to collect different types of integrative information, including archaeological, architectural and archaeobotabical data, through constructive dialogues with specialists working at Erimi-LtP (see Section 2.1), and to test a methodological approach able to support the thesis aims and to encourage best fieldwork practices in order to enhance the informative potential of the evidence analysed, and thereby strengthen final archaeological interpretations (see Chapter 2).

This thesis research is part of an interdisciplinary project in the middle valley of Kouris River, which is aimed at reconstructing the socio-cultural and economic development at Middle Bronze Age Erimi-LtP and, in a broader perspective, at examining the role of this settlement in the formative process of urbanisation in the Kouris Valley region and more generally in Bronze Age Cyprus (Bombardieri 2017). My thesis research provides some important insights into this broader project, by examining the formative period of urbanisation through analysis of architectural evidence and more specifically of non-elite architecture, as key arena of social action and reproduction (Amadio 2017; Bombardieri *et al.* 2017a; 2017b). Research on Cypriot urbanisation has principally stressed the fundamental role of monumental architecture as elite-place making (Knapp 2009; Fisher 2007; 2009a; 2009b; 2011; 2014c). On the contrary, my research aims at examining the significant role of households and non-elite buildings as places that materialised social boundaries and structured social interaction, contributing to transform social practices, roles and relationships (Fisher 2014a).

To address the possible shortcoming of analyses and interpretations that are based on a single context, the data-set resulting from the analyses conducted at Erimi-LtP are compared with evidence from other Early, Middle and Late Cypriot sites. This approach permits to broaden the view by examining aspects of transformations in architectural materials, forms and practices and use and concept of space between Early Cypriot village-based societies and Late Cypriot Urban societies (see Chapter 8).

4. MICROMORPHOLOGY: CLASSIFICATION OF COMPONENTS AND DEPOSIT TYPES.

4.1 Introduction

The aim of this chapter is to classify the components and deposit types identified initially in the field, based on their distinctive macroscopic characteristics and contextual locations, and subsequently to refine these on the basis of their observed micro-morphological attributes. Analysis of micromorphological attributes and the classification of components and deposit types permit reconstruction of pre-depositional, depositional and post-depositional pathways of archaeological deposits and materials, and provide a valid data-set with which to identify and interpret stages in the life-history of buildings (Banerjea *et al*. 2015). Understanding these formation processes is central to interpreting the archaeological record and, more widely, to reconstruct socio-cultural and economic dynamics in the context analysed (see Section 1.2.4; Schiffer 1987; LaMotta and Schiffer 1999).

Each of these component and deposit types is further examined in Chapter 5 in critical analysis and discussion of architectural materials and technology, and in Chapter 6 and 7 with regard to the micro-history of key areas of the settlement of Erimi-LtP.

The definition of 'deposit' is used here to refer to a stratigraphic unit that has been observed and defined during analysis in the field and in thin-section. As Schiffer (1987, 265-266) stated, "a deposit is a three-dimensional segment of a site… … an entity created by some minimal unit of deposition, either cultural and noncultural". A deposit comprises physical components of both natural and anthropic origin. Each of these components can contribute to informing on cultural behaviour and settlement history (Matthews *et al*. 1997, 282), hence the importance of deposits in the study of archaeological contexts, and their analysis and classification. In reflexive archaeology, however, there is also greater emphasis that recognition and definition of deposits are also a construct of the excavator and analysts (see Section 2.3; McAnany and Hodder 2009). Classification of deposit types permits identification of significant associated characteristics that are discernible by observations and contextual information in the field, and then by analysis of the wide range of attributes recorded in micromorphological description (Matthews 1992, 48). The recording of classes of associated components and morphological attributes is a fundamental step in producing a classification of deposit types and evaluating their spatial and temporal variation and thereby depositional, ecological and socio-cultural significance.

This research project applies a combination of macro and micro techniques in order to identify and classify the deposits recorded in the study-area. The multi-scalar and interdisciplinary approach used in this project allows the acquisition of different types of information in order to test and thereby strengthen the characterisation and interpretation of the components and deposits sampled and analysed using specific individual techniques. Application of this multi-focused and multi-proxy approach permitted the identification and classification of 13 major deposit types at Erimi-LtP.

An overview of environmental issues and post-depositional alterations introduces the classification of components and deposit types to evaluate the impact of natural and anthropogenic agencies in the preservation of deposits and materials at Erimi-LtP.

4.2 Preservation environment and post-depositional alterations

The climatic and environmental conditions of the southern region of Cyprus, characterised by dryness as consequence of the lack of water, and by soil erosion due to the scarcity of vegetation (Zachariadis 2012, Voulvouli 2013, Panagos *et al*. 2015), together with the geologic and edaphic characteristics of the region, dominated by the sedimentary formation of chalks and marls and calcareous soils, (Hadjparaskevas 2005), have contributed to the alteration of deposits and have impacted on the preservation of archaeological materials, as observed at Erimi-LtP.

The lack of water and vegetation and the consequent soil erosion produced the loss of upper deposits, especially in the open areas, which were more exposed to natural agencies. Differently the preservation of deposits in roofed areas was ensured by the building techniques used in their construction, with the rooms space carved into the limestone bedrock floor (see Sections 6.3, 7.3). Hence, roofed rooms functioned as 'containers', which preserved deposits *in situ* and prevented them from degradation and dispersion by water and wind.

The results from the analysis of Erimi-LtP deposits allowed me to produce an efficient data-set and reference material to address methodological, archaeological and environmental issues at this and other Cypriot contexts, especially considering the limited application of micromophological analysis in the study of archaeological contexts in Cyprus.

The **Post-depositional alterations** observed in the study samples, are related to the following processes:

- **Weathering.** ***Secondary calcite formation*** is the most characteristic pedofeature related with weathering process; this phenomenon is visible even at macroscopic level, recorded in

the field as lime crust formation. Micritic and sparitic calcite neoformation is the principal cause of materials deterioration at Erimi-LtP, as calcite infills void spaces and produces extended cracks, which cause the breakage and subsequent dissolution of the material (Fig. 4.3 a). Secondary calcite was also observed as calcite coatings around voids or grains (Fig. 4.4 a). Calcite neo-formation is ubiquitous in all the deposits analysed. However, its occurrence as minor or major percentages is correlated with two factors. First the composition of the deposit, as calcite rich-materials, as lime plaster, show higher percentages of calcite neo-formation than earthen materials (Fig 4.1 b). Second the depth of the deposit from the surface, since more is the proximity of the deposit to the limestone bedrock floor, higher is the occurrence of calcite neo-formation, since the process of leaching and reprecipitation of calcite is more developed in the proximity of limestone bedrock (Fig. 4.1a; Durand *et al*. 2010; Manafi *et al*. 2012). ***Needle-fibre calcite*** has been identified as a fine interlacing void infilling (Fig. 4.3 b). Needles are 2-10μm wide and 50-600μm long; they possibly originated as result of crystallisation of organic materials (roots, roots hair, bacteria and fungi) or as pysico-chemical crystallisation related to evaporation and desiccation (Durand *et al*. 2010; Owliaie 2012; Verrecchia and Verrecchia 1994). Calcitic needles occur as 30-40% in feature plaster Type 8b and floor plaster Type 9d, as >20% in bricks Types 2b and 2c, are attested in minor percentages (5-10%) in floor plaster Type 6c, mortars Type 7b and bricks Type 2a, and are completely absent in other deposit types. ***Calcite depleted hypocoatings*** are identified as decalcified zones around the void spaces in yellow brick Type 2b (Fig. 4.3 c), in earthen wall plaster Type 4 and in feature plaster Type 8a as 5%. ***Calcified roots*** are observed as 2% infilling in pseudomorphic voids in red bricks Type 2a and red construction material Type 3 (Fig. 4.3 d). These calcitic pedofeatures are closely related with the calcareous geology and edaphic condition of the site area and Cyprus environmental conditions where the hot summer temperatures and the higher water regime of winter favour percolation of water and rapid evaporation, producing recrystallization of soil carbonates. During winter, precipitation percolates down into underlying limestone deposits, and, there, dissolves and leaches out calcium carbonate from the rock. During the long, hot summer the ground water rises to the surface with its calcium content held in solution. Then the water is evaporated and the dissolved calcium is redeposited (Durand *et al.* 2010; Manafi *et al.* 2012; Goldberg and Macphail 2006; Wright 2005). The calcareous and alkaline soils of Erimi-LtP area are also responsible for the poor preservation of siliceous plant materials, as indicated by the sparse occurrence of phytoliths in the deposits analysed in comparison with that found in most of other Near Eastern sites

(see 4.2.1; Boivin and French 1995; Matthews 2010; Piperno 1988, 2006; Cabanes and Shahak-Gross 2015).

Redox pedofeatures were observed as dark Fe/Mn nodules with clear edges in bricks Type 2a and 2b and in ceramic pottery Type 13c and 13d (5%) (Fig. 4.3 e), possibly inherited from the raw material, where these ferruginous features formed as consequence of fluctuation between dry and humid phases, which characterise the semi-arid Mediterranean climate (Courty *et al.* 1989, 180-181; Friesem *et al.* 2011). Impregnative redox pedofeature with diffuse edges were identified as <5% in bricks Type 2b (Fig. 4.3 f), constructional packing deposits Type 10a and mortar Type 7b, possibly associated with decomposition processes of organic matter, mixed with the heterogeneous inorganic components of these packings (Courty *et al.* 1989, 146-180) and as sporadic pedofeatures (>2%) possibly as a result of higher degree of weathering and release of Fe/Mn from primary minerals (Owliaie 2012).

Translocation of fine particles is indicated by orange/brown clay coating in voids or around limestone inclusions. Silty clay coatings (Fig. 4.3 h) were mostly observed at the top level of the stratigraphic profile, related to the easier filtration of water through the upper stratigraphic profiles, where the percolation and the downwards transportation of fine materials is not obstructed by the thick, hydrophobic layers of plaster floors (Fig. 4.1 a; Goldberg and Macphail 2006, 43-71; French 2003, 53-54). Translocated clay particles were observed as very localised features in earthen wall plaster KVP14.30, Type 4, possibly deriving by water movement into the porous structure of the materials and weathering under wet condition (Fig. 4.3 g; Friesem *et al.* 2011; Friesem *et a*l. 2014).

- **Bioturbation:** this process is also attested macroscopically in the settlement area, even if it is stronger in Area B, where roots penetrated in the lower stratigraphic levels, causing strong reworking and, in some areas, the loss of the original stratigraphic deposition. This process is less attested in Area A, were the erosion of soil, and the shallow soil horizons, make possible only the growth of shrubs and little bushes with smaller roots. However, in Area B, where the soil horizons are deeper, since the terraced morphology of the hills allowed the deposition of sediments and materials eroded and transported from the top of the hill, small tree species, as carob trees, are present. Their roots, as the lack of water, penetrate down to the lower levels of the stratigraphy; here, because they cannot grow in depth, since the presence of the bedrock floor, they expand sideways on the available surface (Boivin and French 1995). Post-depositional bioturbation by micro flora and fauna, together with

secondary calcite formation, have in some cases homogenised the deposits, making boundaries between layers diffuses and difficult to distinguish without the support of stratigraphic and archaeological evidences (Boivin and French 1995). ***Reworking:*** bioturbation has been identified in thin-sections as reworked areas with granular and crumble structure (Fig. 4.4 a) and as ***channels and burrows***, with silty clay infillings, when the alterations were caused by micro fauna (Fig. 4.4 b). The upper deposits are the more affected by these alterations, since the harder layers of plaster floors create a 'barrier' against micro faunal and floral activity. Furthermore, these alterations are more pronounced in deposits rich in organic remains since they attract micro-organisms, as in packing Type 10b and destruction deposit Type 12a, where the micro fauna channels and burrows are infilled with excrements (Fig. 4.1). ***Excrements*** were observed as smooth, ellipsoidal, organo-mineral pellets of 20-40μm, brown in colour. Some of the pellets, in packing Type 10b, are mixed with calcified, circular features, of 20μm, which are possibly altered excrements (Fig. 4.4 c, d; Kooistra and Pulleman 2010, 411-413).

Although the bioturbation of deposits analysed initially seemed to preclude effective micromorphological application and analysis, it was observed that Erimi-LtP deposits still retained important information. As pointed out by Boivin and French, referring Crowther *et al.* (1985), "well preserved sites are not the majority of existing archaeological contexts" (Boivin and French 1995, 183-185).

- **Fire**: The presence of evidences of post-depositional fire event, as product of human agency, is significant for the reconstruction for the life-history of the settlement and may support speculations on possible socio-cultural practices related with the firing/burning of the structures, and shed light on possible rituals of abandonment (see Chapters 6 and 7; Stevanovic 1997). This process is attested by three distinct features: the occurrence of >5% ***altered rocks and minerals*** in bricks Type 2a, construction materials Type3 (Fig. 4.4 e, f), in feature mortar Type 7b and in feature plaster a 8b, and 2% ***altered fossils*** in brick Type 2c; the ***reddening*** of the external surfaces in red bricks Type 2a and construction material 3a (Fig. 4.4 g); the ***vitrification*** of construction material Type 2a, KVP14.29 and KVP14.32, attested by the cloudy greenish colour of the fine material on the external surface of the samples (Fig. 4.4 h; Quinn 2013). The exposure to fire ensured the preservation of these perishable materials in the archaeological record, through the baking and strengthening of their internal structure (Stevanovic 1997).

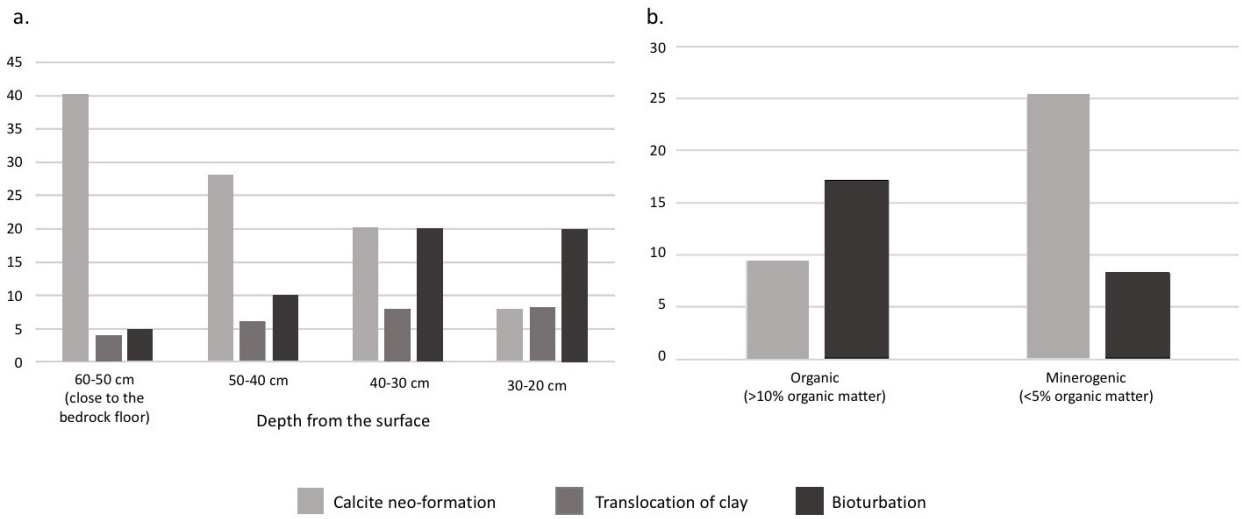


Figure 4.1 Bar chart showing: a) the relationship between the occurrence of pedofeatures and the depth of the deposits from the surface. Only three of post-depositional alterations observed are reported in the graph, as they are ubiquitous in the deposits analysed. The values were calculated measuring the average of the percentages of pedofeatures occurrence in the deposits, at different depth from the top soil. As illustrated in the graph, the deposits, which are closer to the bedrock are more affected by calcite neo-formation, while those that are closer to the surface are more affected by bioturbation and translocation of clay particles; b) the relationship between the occurrence of post-depositional alterations and the composition of the deposits. The graph reports only calcite neo-formation and bioturbation since these are the principal pedofeatures attested at Erimi-LtP, whose occurrence is more affected by the composition of deposits. The values were calculated measuring the average of the percentages of these two pedofeatures in organic deposits with > 10% organic matter and minerogenic deposits with <5% organic matter. The graph shows how organic deposits are more affected by bioturbation, while minerogenic deposits as plaster floors are more altered by calcite neo-formation.

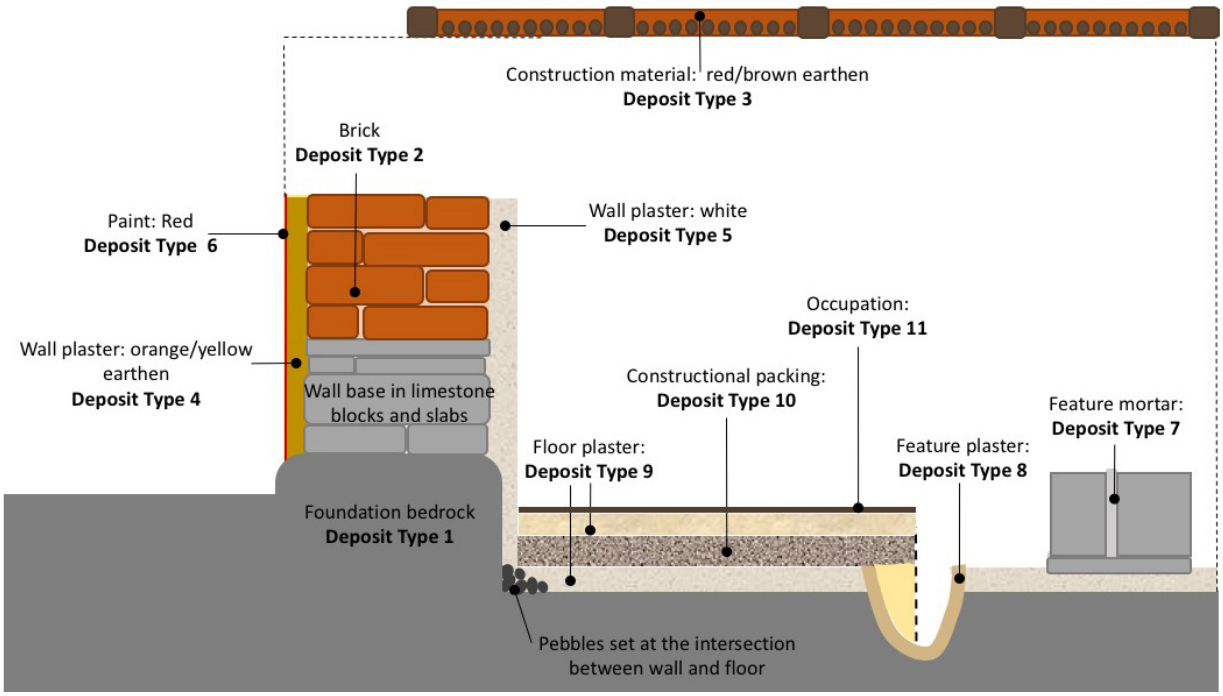


Figure 4.2 Schematic graph showing the building technique used at Erimi-LtP and the identified deposit Types.

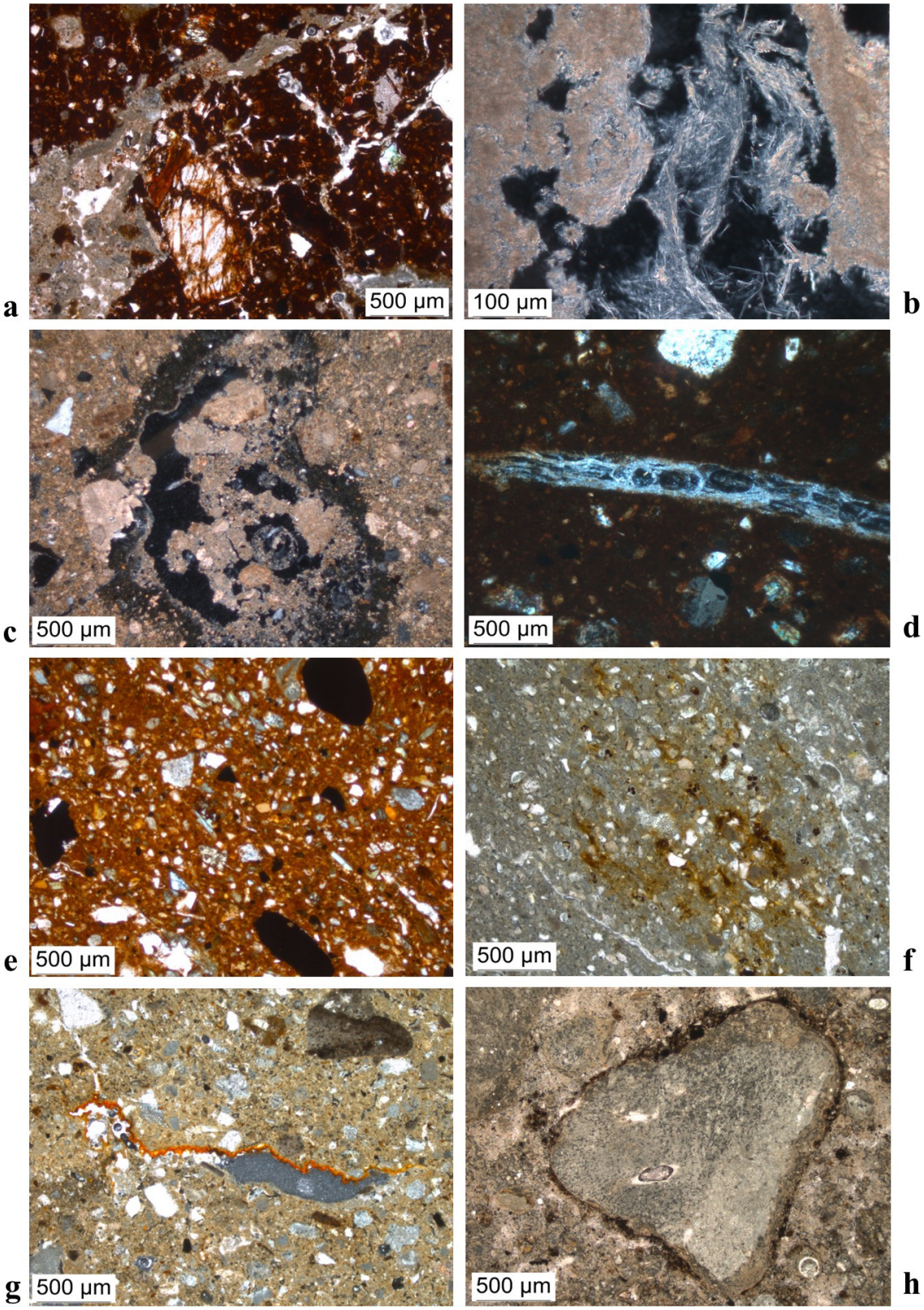


Figure 4.3 Photomicrographs of post-depositional alterations. a) Secondary calcite formation filling a void and creating long cracks in the internal structure of the material; sandy clay loam construction material KVP13.29, Type 3, PPL; b) Void lined with needle-fibre calcite; they create a fine interlacing partial infilling; withe silty clay loam brick KVP13.16, Type 2c, XPL; c) Calcite depleted hypocoating: dark, isotropic area around the void in yellow silty clay brick KVP13.1, Type 2b, XPL; d) calcified root infilling a pseudomorphic void in red silty cay loam brick KVP13.3, Type 2a, XPL; e) Dark Fe/Mn oxide nodules, with clear edges, embedded in the silty clay loam of red brick KVP13.3 Type 2a; PPL; f) Impregnative redox pedofeature, with diffuse edges, possibly attributed to the decay of organic matter in yellow sandy clay loam brick KVP13.172, Type 2b, PPL; g) Translocated limpid orange clay in yellow, silty clay loam wall plaster KVP14.30, Type 4, PPL; g) Silty-clay coating around a limestone aggregate in mortar KVP13.19, Type 7b, in PPL.

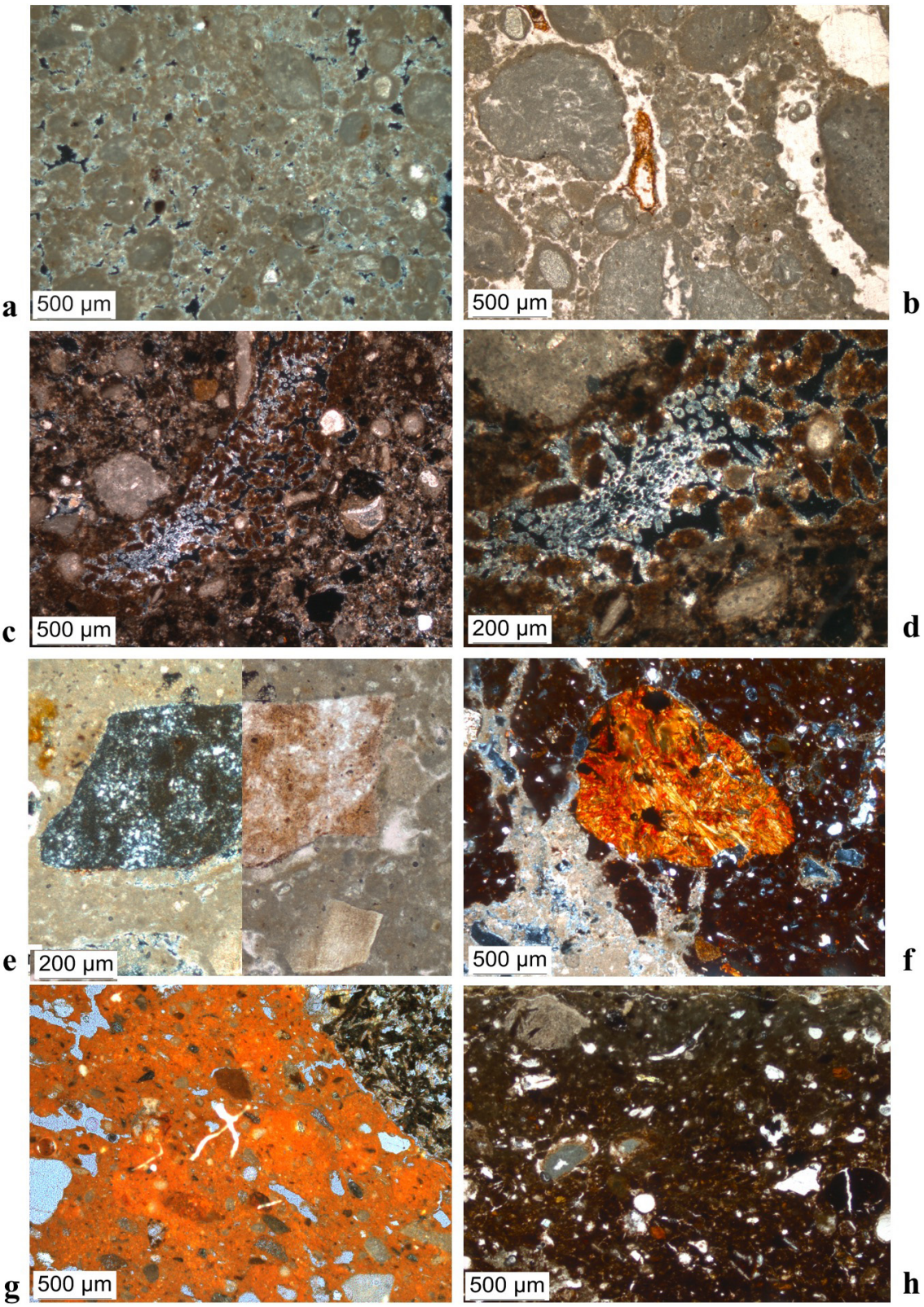


Figure 4.4 Photomicrographs of post-depositional alterations. a) Micritic calcite coating the granules of a reworked area in constructional packing KVP13.171, Type 10a, in XPL; b) Bioturbated area in constructional packing KVP14.3, Type 10a; a modern root is visible on the channel void on the left, in PPL; c) Smooth, ellipsoidal, organo-mineral excrements in a channel void mixed to calcified circular pellets of 20µm; packing deposit KVP14.5/460, Type 10b, XPL; d) Close up of the calcified circular features in packing deposit KVP14.5/460, Type 10b, XPL; e)Altered chert embedded in feature plaster KVP13.9, Type 8b, XPL on the left and PPL on the right; f) Altered igneous rock embedded in construction material KVP13.32, Type 3, XPL; g) Reddening of the groundmass in red, silty clay loam brick KVP13.2, Type 2a, OIL; h) Vitrification of the groundmass, visible in the cloudy, green colour of clay; more evident on the top of the photomicrograph; construction material KVP13.29, Type 3; PPL.

4.3 Component types

A brief examination of the main component types identified in thin-sections is presented and examined first in this section, particularly as analysis of presence and abundance of each of these components is critical in the characterisation, interpretation and classification of deposit types.

This section discusses characteristics of each component, then examines their occurrence and contextual variation in construction materials, packing materials, occupation and destruction deposits, according to the common order in which they would have been deposited in the history of a place.

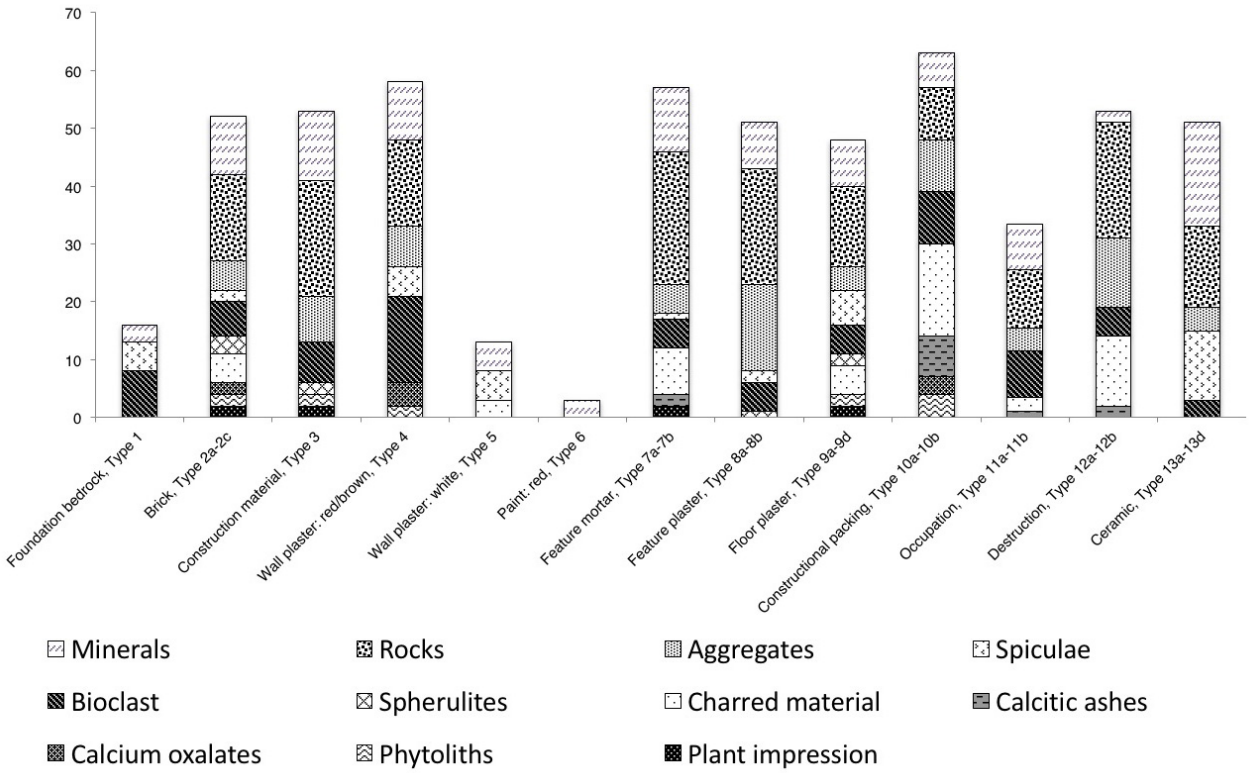


Figure 4.5 Bar chart showing absolute abundance of component types in each of the macro deposit types identified. The absolute abundance of components in macro deposit types was obtained calculating the average between the percentages of abundance of every component in each deposit sub-type identified (e.g. the average between recorded values of plant impressions in brick Types 2a, 2b, 2c).

4.3.1 Plant remains

A wide range of plant remain types have been analysed and identified at Erimi-LtP.

- *Plant impressions* were identified in thin-sections as planar voids with sharp and often parallel edges (Fig. 4.7 a). This component is frequent in mud-bricks, even if in low percentages (2%) and can be attributed to decayed vegetal temper used in brick and plaster manufacture (Goldberg 1979; Courty at al. 1989; Matthews *et al*. 1997, Macphail and

Goldberg 2010; Matthews 2010; Friesem *et al*. 2014b). These pseudomorphic voids were observed in association with calcified plant remains that infilled these voids in red bricks, Type 2a, KVP13.2, KVP13.3, and red constructional materials, Type 3, KVP14.32, KVP14.33. Plant impressions were scarcely identified (< 2%) in other building materials such as plasters and ceramic and not identified in other deposit types. The low abundance of plant impressions, therefore, may be attributed both to the sparse use of plant temper in building material production but also in a range of instances to post depositional disturbance of the deposits due to faunal and floral activity and secondary calcite formation, which penetrated in the porous structure of the deposits and perturbated and destroyed the structure of the original void space (Fig. 4.1 d).

- *Siliceous opal phytoliths* were identified as isotropic single cells or disarticulated cells (Courty *et al.* 1989, Piperno 2006) in thin-section. Single cell grass phytoliths were occasionally identified in building materials and destruction deposits. Disarticulated phytoliths were observed in constructional packing Type 10b, KVP14.5.460, associated with charred plant material and calcitic ashes. The scant presence of phytoliths in all the deposits analysed may be to the poor preservation of siliceous materials such as phytoliths in alkaline soils such as the calcareous soils of Kouris valley area (see post depositional alterations; Piperno 1988, 2006; Albert and Weiner 2001; Cabanes and Shahak-Gross 2015).

- *Calcium oxalate* prismatic crystals may be present in some plants and plant parts, usually concentred in the leaves (Canti 2003; Weiner 2010). Calcium oxalates of 15-50μm were observed as single, sporadic, quadrangular crystals in building materials sometimes associated with calcareous dung spherulites, which are characterised by smaller size (5-10μm). In one case, calcium oxalates were observed as clustered, articulated crystals in constructional packing Type 10b, which possibly included hearth rake out material (Fig. 4.7 b; Durand *et al.* 2010; Weiner 2010).

- *Calcitic ashes* are pyrogenic calcite crystals resulting from combustion of plants at temperatures below 400-500°C and are characterised by high birefringent colours (Fig 4.7 d; Canti 2003; Matthews 2010; Weiner 2010). Calcitic ashes were observed in thin-sections as redeposited material, mixed with other components. In constructional packing, Type 10b, calcitic ashes were observed as scattered ash clusters (<20%) mixed with burnt aggregates, charred materials and disarticulated phytoliths. Ashes were also observed in occupation deposits as sporadic inclusion associated with charred material, in destruction

deposits, Type 12a (5%), mixed with burnt aggregates and charred flecks. The identification of calcitic ashes, however, can be problematic especially when dispersed in fine-grained calcite sediments, (Canti 2003; Weiner 2010, 172-174). In fact, the calcium oxide produced by combustion of wood has an identical composition to calcium oxide produced by heating limestone to obtain plaster or mortar (Chu *et al*. 2008, Regev *et al.* 2010; Xu *et al.* 2015). Therefore, especially in calcite-rich environments such as Erimi-LtP, which favour ash preservation but make ash identification more problematic, the integration of micromorphology with spectroscopic techniques is highly recommended and ideally essential to improve the analysis and interpretation of archaeological data-set.

- *Charred remains* only represent plants that have been burnt at low temperatures, generally <400-500 °C; above these temperatures carbon is combusted and plant remains are preserved as phytoliths and/or ashes (Matthews 2005a; 2010; Boardman and Jones 1990). Charred materials were identified in thin-section both as small size flecks (from 10-20µm to 200-500µm), and as bigger fragments (up to 2mm) with the internal structure preserved (Fig. 4.7 c). However, the taxonomic identification of these bigger charred wood fragments has not been possible due to the lack of representative sections of wood internal structure and small fragment size. Carbonised plant remains/wood were identified as accidental or deliberate inclusions in building materials (5%) and in packing deposits (10-15%), as primary refuse in occupation deposits (2-5%), and in destruction deposits associated with burnt sediments and ashes (>10%).

4.3.2 Dung-derived components

- *Calcareous spherulites* of 5-10µm, individuated in thin-section by their characteristic extinction cross, have been identified frequently in association with dung-derived remains, and are generally more abundant in herbivore than omnivore dung (Canti 1997; 1999; Matthews 2005b; 2010). They can be distinguished from calcium oxalates by their smaller size, 5-10um (see above). Spherulites were observed randomly distributed in the groundmass of bricks (<5%) and plasters (5%), possibly related with dung used as additive in building material production (Fig. 4.7 e; Keefe 2005; Matthews 2005b; Tung 2005; Shahack-Gross 2011). Because the secondary calcite formation on many of the deposits analysed, spherulites were more readily identified around voids edges sometimes mixed with calcium oxalates crystals.

4.3.3 Other biogenic components

- *Calcareous bioclasts* were widely observed in thin-sections. Among them foraminifera are ubiquitous in all the deposits analysed; these fossils indeed are the principal fossiliferous component of the underlying local limestone deposit of Pakhna formation (Robertson 1998). Bivalves, echinoderms, gastropods and cephalopods also occur in plasters and packings of Type 10a (Fig. 4.7 f). In many cases these fossils are embedded in limestone inclusions (recorded as fossiliferous limestone; Fig. 4.8 g).

- *Siliceous bioclasts*. Spicules were observed as isotropic inclusions both in cross and longitudinal section with a distinctive axial canal (Fig. 4.7 h; Drees *et al*. 1989, Gutierrez-Catorena 2010). The diameter and dimension of spicules observed in deposits analysed can vary from 40-100µm and 250µm -2,5mm (Fig. 4.7 g). These spicules may be inherited from the chalk and marl deposits of the Miocene Pakhna formation, as documented by geological studies (Robertson *et al.* 1991; Robertson 1998). This natural calcite deposit was intentionally chosen as favoured raw material for plaster production, possibly because its binding properties. Sponge spicules were identified in many plasters, where spicules occur in abundance as in silty clay plaster floors of Type 9a (15%) and wall white plaster, Type 5 (>5%). The presence of spicule in raw carbonate material indeed may increase the mechanical strength of plasters (Matthews 2010; Gutierrez-Catorena 2010). Radiolarians (Adam and Mackenzie 1998, 98) were also identified as spherical siliceous bioclasts of 100-200µm, embedded in many limestone inclusions.

4.3.4 Sediment aggregates

Several sediment-mineral rich aggregates have been identified in the studied samples and allocated to six distinctive types based on micrormophological attributes of particle size, colour, c/f ratio, void and inclusions types and abundance. The main characteristics of each group of sediment aggregates identified are summarised in Table 4.1.

Sediment types are always referred to in the text with small letter, e.g. sediment **type** 1, to distinguish them from deposit types, which are referred to in capital letter, e.g. brick deposit **Type** 2a.

Table 4.1 Classification of sediment aggregates based on their main micromorphological attributes.

Type	Groundmass	Inclusions	Interpretation
1	Silty clay- silty clay loam; Orange in PPL, brown in XPL; c/f ratio (20μm): 40/60	5-10% minerals; < 5% charred material (silt size). 2% limestone	Abraded constructional material
2	Silty clay; Red in PPL, dark brown in XPL; c/f ratio (20μm): 40/60	15% silty size minerals	Alluvial sediment
3	Silty clay loam; Dark brown in PPL, black in XPL; c/f ratio (20μm): 40/60	10% minerals 5% rocks 15% charred materials	Burnt aggregates
4	Silty clay; Grey/buff in PPL and XPL; c/f ratio (20μm): 20/80	5-10% minerals	Calcareous aggregate/plaster
5	Silty clay; Pale yellow in PPL, Isotropic in XPL; c/f ratio (20μm): 20/80	2-5% minerals	Phosphatic aggregate
6	Well sorted silty clay, Yellow in PPL, pale brown in XPL; c/f ratio (20μm): 20/80 Depletion hypocoating	5% minerals	Alluvial source?

As shown in Table 4.1 sediment aggregates of type 1 and 2 are distinguished from each other by their particle size, colour and components. Type 1 aggregates are orange, with 5-10 minerals, 5% of silty size charred matter, and 2% limestone; the presence of plant voids in some of these aggregates, even if attested as <2%, possibly suggests that they are abraded constructional materials (Fig. 4.8 a). Type 2 aggregates instead are characterised by a vivid red colour, with 15% sorted minerals, mainly quartz and have a rounded shape; the sorted silty clay particles of these aggregates, with, in few cases, internal bedding, suggests a possible alluvial origin of these aggregates (Figs. 4.8 b). Both types 1 and 2 occur in all the deposits analysed, with the exception of wall plaster, pigment and natural limestone bedrock (Fig. 4.6). These sediment aggregates, are present as temper/inclusions in constructional materials and ceramic and as structural debris in packing and destruction deposits. They occur in low percentages (2-5%) in fine lime plaster floors (Type 9a), where exotic sediment aggregates are otherwise completely absent. Burnt aggregates, type 3, occur in floor plasters as residual material or allochthonous aggregates transported and re-deposited by faunal/floral activity (<5%), in occupation deposits as possible residual refuse (2%) and in packing as re-deposited material, perhaps selected as hard core (5%). This burnt aggregates principally characterises destruction deposits (10%) as relict material of degraded structures (Fig. 4.8 c). Carbonate aggregates of type 4 are mainly

present in plasters (2-5%) bricks and red/earthen constructional materials (2%) as possible lime pellets added to increase the binding properties of these materials (Houben and Houbert 1994; Keefe 2005); they may also be relict marl material of soils mined above limestone bedrock. Phosphatic silty clay aggregates, type 5, have a pale-yellow colour in PPL and are isotropic in XPL; they are attested just as 2% in yellow bricks Type 2b and feature plaster Type 8a (Fig. 4.8 d). Waterlain aggregates characterised by yellow silty clay with banded bedding, type 6, occurs just in one case, in packing deposit Type 10a (2%).

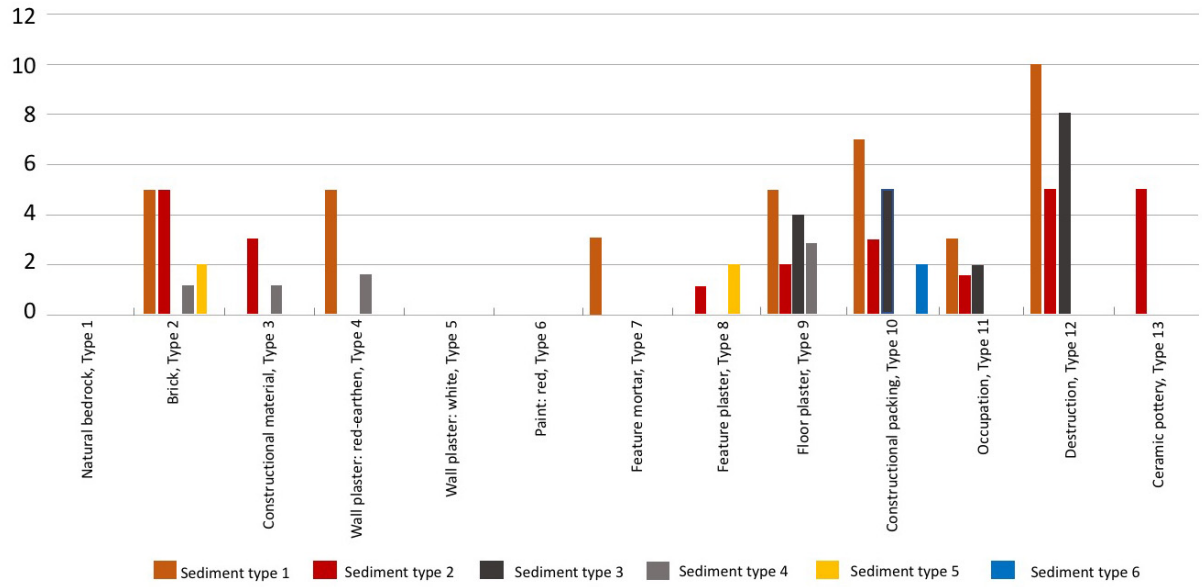


Figure 4.6 Relative abundance of sediment aggregates in the analysed deposit types.

- *Architectural material aggregates* from bricks and plasters were identified by their colour and components. Calcareous plasters aggregates have been identified by a distinctive grey/buff colour and a silty clay, silty clay loam matrix, generally of big size 5mm-2cm, and resemble in-situ plasters e.g. plaster floors Type 6a, 6b, 6c. Bricks and earthen constructional materials were distinguished by their red-orange colour, and by comparison with the identified deposits Type 2 and 3. Fragments of plasters, which show sequences of thin, white plaster layers and red wash/painting layers, occur in packing KVP13.171, Type 7a, and destruction deposit KVP14.1/685, Type 10b (Fig. 4.8 f).

- *Ceramic* fragments were observed in thin-sections and identified by their morphology with finished sharp and smoothed edges in a range of cases, indications of firing, and frequently had silty-sandy clay loam fabrics characterised by >20% rock and mineral inclusions. The colour varies from orange to dark red and brown depending on their composition and firing atmosphere (see Ceramic, deposit Type 13; Quinn 2013). Over-fired/vitrified ceramics/kiln fragments were identified for the greenish, opaque cloudy groundmass, the

presence of vesicles and of altered rock and mineral inclusions. The highest percentage of ceramic/brick fragments (30%) was identified in feature plaster (Type 8a), where these materials are the principal inclusion type. These inclusions were possibly mixed to the lime groundmass to improve the mechanical strength of these plasters (Fig. 4.8 e; Phylokyprou 2011; Regev *et al*. 2010; Moropoulou *et al*. 2005).

4.3.5 Rock fragments

Rock fragments occur abundantly in all the deposits analysed and are representative of the geological formations and alluvial deposits of the Kouris valley area. Sedimentary rocks are the most frequently attested. Among them micritic and fossiliferous limestone were ubiquitous (Fig. 4.8 g). Cherts observed in the deposits analysed are characterised by small size (1mm max.) and rounded shape, suggesting that they were transported and deposited by natural agents (Fig. 4.8 h; Matthews 2005a; Goldberg and Macphail 2006). They principally occur in bricks and earthen construction materials (>5%), less in the other deposit types (<2%). Basalts, gabbro and dolerite are the principal igneous rocks observed in the deposit analysed. These rocks types are part of the volcanic/ophiolitic deposits of Troodos Mountain, and deposits from these that have been transported and re-deposited along the Kouris River Valley (Lagroix and Borradaile 2000). These occur in bricks Type 2a, and construction material Type 3 (5-10%) and predominate in ceramics pottery Types 13a and 13c (20%).

4.3.6 Mineral grains

Quartz is the predominant mineral in in all the deposit analysed and it appears as sub-rounded/sub-angular and angular mineral of different size, from few microns up to 500μm. Calcite is also dominant, especially in carbonate-rich samples as plasters, however, it was not possible to identify calcite as relict mineral grain and differentiate it from post-depositional secondary calcite formation, which greatly affects the deposits at Erimi-LtP. Feldspars of plagioclase family and pyroxene are frequent in bricks, red/earthen constructional materials and ceramic together with other, less abundant minerals as olivine and muscovite, but completely absent in the other deposit types.

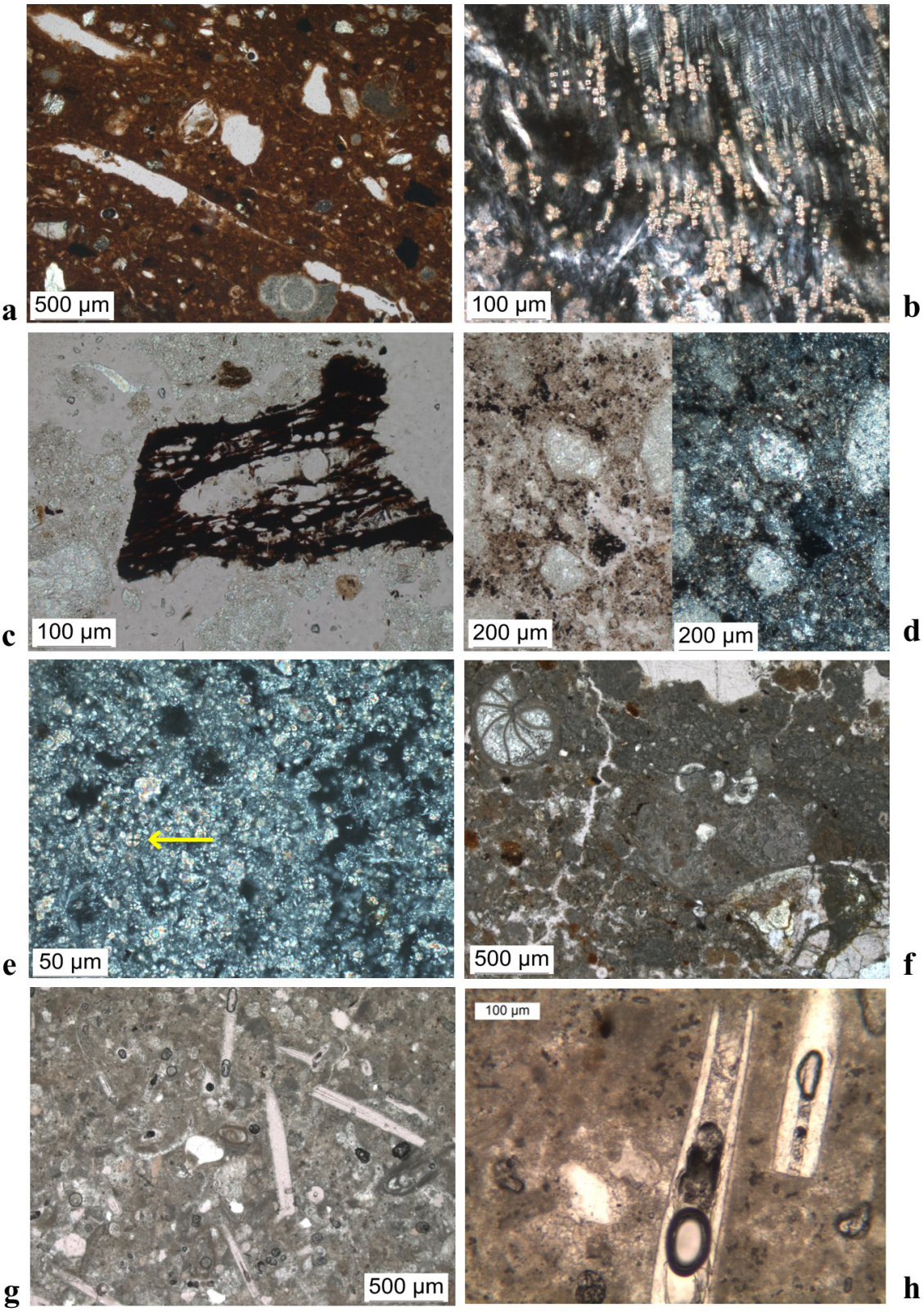


Figure 4.7 Photomicrographs of plant remains and other biogenic components: a) Plant pseudomorphic voids, in red brick, Type 2a (PPL; KVP13.3); b) Articulated calcium oxalate druses of 25-30µm, possibly from a modern root (?) embedded in constructional packing Type 10b (XPL; KVP14.5/460); c) Charred wood, with the internal structure preserved, embedded in floor plaster Type 9d, as accidental manufacture residue (PPL; KVP14.2/697); d) Calcitic ashes dispersed in the groundmass of a burnt mortar, light grey PPL (on the right), high order birefringence in XPL (KVP13. 19); e) Calcareous spherulites of 5-10µm in silty clay floor plaster, Type 9a, possibly relicts of dung added as additive (XPL; KVP13.11); f) Bioclasts in packing Type 10a; a cephalopod on the top left and foraminifera in the centre (PPL; KVP14.2/696); g) Siliceous sponge spicules in floor plaster Type 6a, visible both in cross section (circular inclusions) and longitudinal section (elongated inclusions); h) Longitudinal section of two spicules, with the characteristic axial canal (PPL, KVP13.21).

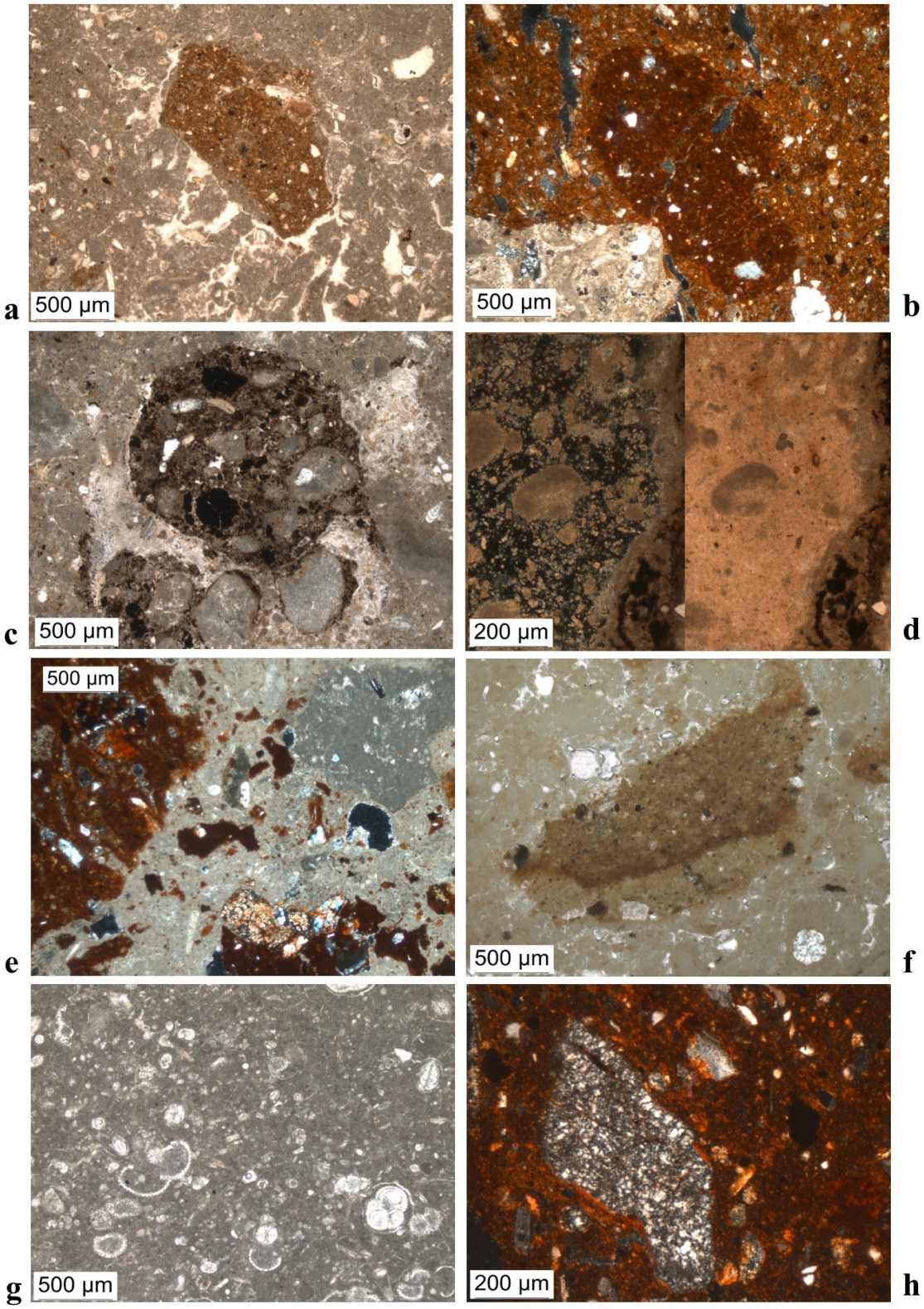


Figure 4.8 Photomicrographs of sediment aggregates and rocks: a) Sub-rounded, orange, silty clay loam sediment aggregate of type 1 embedded in packing Type 10a (PPL; KVP13.171); b) Rounded, red, silty clay loam sediment aggregate of type 2 embedded in red-brick Type 2a (XPL; KVP13.3); c) Rounded, sandy clay loam, burnt aggregate of type 3 embedded in plaster floor Type 9c (PPL; KVP13.5); d) Silty clay loam phosphatic aggregates of type 4 embedded in feature plaster Type 8a; in PPL on the right and in XPL on the left (KVP13.6); e) Ceramic fragments, different from sediment aggregates for their angular shape embedded in the lime groundmass of feature plaster Type 8a; on the top right a grey, calcareous aggregate, type 4 is also visible (XPL; KVP13.16); f) Fragment of plaster sequence, a micro-layer of or red paint (in the middle) is applied on brown silty clay loam plaster (?). Another layer of white, silty clay plaster is applied on top of the red paint, in packing KVP13.171, Type 10a, PPL; g) Fossiliferous/foraminiferous limestone embedded in feature plaster Type 8b (PPL; KVP13.17); h) Rounded, chert fragment in red construction material Type 3 (XPL; KVP13.32).

4.4 Deposit types

In the field, preliminary deposit types were identified and classified by examination of their spatial and stratigraphic context and through the recording of distinctive macro characteristics of each deposit, notably colour, texture and consistency. Micromorphology then allowed high-resolution distinction of individual strata and specific bioarchaeological, mineral and micro-artefactual components and their attributes and associations within depositional units. Higher resolution analysis of *in situ* micro components and layers were then applied using spectroscopic micro-chemical techniques (SEM-EDX) to analyse a wide range of properties of specific components and features. Cross-referencing with the field observation assisted micromorphological analysis by enabling reflexive examination of the nature, association and significance of micro-attributes of components and deposits in relation to macro-attributes of the space analysed. This step was useful to contextualise and validate the microscopic analysis and interpretation of deposits.

The most significant attributes considered in the analysis and classification of deposit types and the importance of each of these attributes in the description and distinction of each deposit-type are illustrated in Table 4.2. These attributes have been identified as those that are particularly informative in characterising deposit types and particularly relevant to the identification of similarities and differences within same categories as well as between different categories of deposits. For example, particle size and sorting enable distinction between the origins of components (natural water-laid deposits are well-sorted, anthropic deposits often unsorted), and microstructure and related distribution are informative of manufacture (as plugging and mixing of clay, for example, often result in an embedded related distribution with few packing voids). Different types of inclusions give indications of procurement areas and technologies in architectural materials, and traces of activities in occupation deposits (Matthews *et al*. 1996; Goldberg and Macphail 2006).

Thirteen deposit types and associated sub-types have been identified. Each deposit sub-type is described in this section, presenting the micromorphological characteristics analysed, including colour, particle size, micro-fabric (fine and b-fabric, related distribution, microstructure) and coarse materials/components. The distinctive characteristics of each sub-type are then interpreted to reconstruct their pre-depositional and depositional history.

Table 4.2 The characteristic attributes considered for classification of deposit types. ••• indicates the most important attributes taken into consideration in the analysis and classification of deposit types; •• indicates important but not fundamental attributes; • indicates secondary attributes, which have a limited importance in the characterisation of deposit-types; - indicates the irrelevant attributes.

Deposit types		Characteristic Attributes							
		Particle size	Sorting	Fine material	Colour	Microstructure	Organic inclusions	Inorganic inclusions	Anthropogenic artefacts
1	Foundation bedrock	•	•	•	•	•	-	•	-
2	Brick	•••	•	•	•••	••	••	•••	-
3	Construction material	•••	•	•	•••	••	••	•••	-
4	Wall plaster: red/brown earthen	•••	•	•	•••	••	••	•••	-
5	Wall plaster: white	•••	•	•	•	••	•	•••	-
6	Paint: red	•	-	••	•••	-	-	•	-
7	Feature mortar	•••	•	•	••	•	•	•••	-
8	Feature plaster	•••	••	••	•••	••	•	•••	
9	Floor plaster	•••	•	•	••	••	•	•••	-
10	Constructional Packing	••	•	•	•••	••	••	•••	••
11	Occupation	••	-	•	•••	••	•••	•••	•••
12	Destruction	••	-	•	••	••	•	•••	••
13	Ceramic pottery	•••	••	••	•••	••	-	•••	-

4.4.1 Deposit Type 1. Foundation bedrock

Many early Phase B floors were constructed by carving the limestone bedrock floor and using the resulting exposed surface directly as a floor.

This marly bedrock is characterised by well-bedded layers, which alternate compact white-yellow micritic deposits with >10% bioclasts, 2% spicuale and 5% minerals, to yellow, void-rich micritic deposits. This laminar formation may represent different calcite accretion phases (Robertson *et al*. 1991, Durand *et al.* 2010,157-158).

Table 4.3 Foundation bedrock**,** deposit Type 1, in relation to its contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
1. Foundation bedrock	KVP14.3	Wide roofed space	Area A – SA VI	699	B
1. Foundation bedrock	KVP14.2.I	Wide roofed space	Area A – SA VI	699	B
1. Foundation bedrock	KVP14.4.I	Wide roofed space	Area A – SA VI	699	B
1. Foundation bedrock	KVP14.7	Roofed room	Area A – SA IIa	532	B

4.4.2 Deposit Type 2. Brick

Bricks were identified in the field in collapsed wall structures and successively sampled and analysed in thin-sections.

Colour, particle size and type and abundance of inclusions were the main micro-morphological attributes taken in consideration for the classification of brick types (see Table 4.2). Three sub-types have been identified.

Type 2a: Red-silty clay loam brick.

Description: This type comprises red to red-brownish poorly sorted silty-clay-loam, with a crystallitic b-fabric, an embedded related distribution and up to 10% voids, mainly vughs and cracks; the c/f ratio is 40:60. It is composed of very fine red clay with 10% sub-angular /sub-rounded limestone of 50µm-5mm, 5% rounded/sub-rounded chert of 100-300µm, 5% angular/sub-angular altered igneous rocks of 100 µm-2mm, >10% minerals, including angular, sub-angular quartz (<5%), feldspar of plagioclase family (2%), pyroxene (2%) and amphibole (2%), >5% bioclasts, manly foraminifera. Other characteristic components are 5% red-brown silty clay aggregates of type 2 (Fig. 4.6) rounded in shape and <2% calcareous aggregates of type 4. Less than 2% pseudomorph plant voids were identified; 1% of these includes 'calcified' inclusions. These look like phytoliths under PPL but are high birefringent under XPL (Fig. 4.3 d). <5% small particles (20,100µm) of charred organic matter were also observed in the groundmass.

Interpretation: *The vivid red, red-brownish colour, the silty clay loam matrix and the high content of silicates (quartz, plagioclase and pyroxenes/amphiboles) of these mud-bricks suggest that an iron rich source, characterised by igneous rocks and minerals, was used in their manufacture. The angular and sub-angular shape of many rocks and mineral grains excludes the possibility that an alluvial material source was used for the manufacture of these bricks. The abundance of limestone inclusions suggests that Pleistocene/Holcene terra-*

rossa/terra-fusca soil, which forms on limestone parent materials and it is characteristic of the middle-lower course of river Kouris valley (Verheye and De la Rosa 2005; Durn 2003; Macphail 2008) was used for producing these mud-bricks. Rounded silty clay red/brown aggregates may be a deliberate addition to improve the plasticity of clay material (Quinn 2013, 44-61), while the 2% pseudomorphs observed in the matrix may pertain to plant stabilisers added to the clay matrix to increase tensile strength, malleability and durability (Matthews et al. 1997; 2013; Friesem et al. 2011; Forget et al. 2015; Nodarou et al. 2008). Extended cracks observed on the mud-brick samples may be representative of sparse tempering of the natural sediment (Houben and Guillard 1994; Norton 1997; Keefe 2005). Charred particles scattered in the groundmass may have been introduced either deliberately as temper or accidentally during the manufacturing processes (Matthews 2010; Macphail and Goldberg 2010, 589-622).

Type 2b: Yellow-sandy clay loam brick.

Description: The source material of these bricks is a yellowish-brown (pale brown-greyish at OIL), moderately sorted, fine sandy calcareous clay loam with a c/f ratio 40:60, a crystallitic b-fabric and 10-15% voids, predominantly vughs and cracks. The principal components, embedded in the calcareous groundmass comprise >10% sub-angular/sub-rounded fossiliferous limestone of different size (50μ -1mm), 5% sub-angular/sub-rounded chert of 50μm-1mm, 10% sub-angular/angular quartz of 20-500μm, 5-10% bioclasts and 10% silty clay loam orange-brownish sediment aggregates (type 1). Minor inclusions comprise 1-2 % 5μm spherulites, 2% calcium oxalates of 40μm.

Interpretation: The yellowish-brown, fine sandy calcareous clay loam soil of these bricks, possibly was selected from weathered material from the local Miocene marl, soil horizon B. While limestone, chert and quartz may be residues of the limestone parent material, finer grained sediment aggregates, perhaps from reworked constructional materials, may have been an intentional addition to provide more cohesion to the yellow, highly carbonate soil. The presence of spherulites and calcium oxalates, even if in small percentage, may suggest the use of dung as an organic material temper. The addition of this organic matter in building materials as bricks and plasters is witnessed both in archaeological contexts (Tung 2005; Matthews 2005a; Shahack-Gross 2011, 211) and in experimental and traditional architecture (Houben and Guillard 1994; Norton 1997; Keefe 2005; Boivin 2000). The vughy microstructure can be attributed to poor pugging during manufacture (Matthews 2013; Macphail and Goldberg 2010, 589-622).

Type 2c: White-silty clay loam brick

Description: White-yellowish, calcium carbonate silty clay with a c/f ratio 30:70 a crystallitic b-fabric and a microstructure dominated by 10% vughs and small chambers. 10% limestone inclusions (they look almost homogenised with the groundmass in sample KVP13.16), 2-5% chert, >5% quartz and 10% bioclasts (>5% are altered), among which 5% of spicules (40-100µm in cross section and 100-500µm in longitudinal section), are embedded in the groundmass. 2-5% spherulites of 5µm and 2-5% calcium oxalates of 15-20µm are visible in the voids space.

Interpretation: The pale colour of this brick and the low percentage of minerals and rock inclusions suggest that a highly calcareous marl sediment was used (soil horizon C). Limestone inclusions were possibly occurring in the natural source and not deliberately added, as marl soil, naturally rich in sand particles, does not need to be tempered with sand, differently to plastic clay (Keefe 2005). Organic stabilisers, represented by spherulites and calcium oxalates, were possibly added to improve plasticity, malleability and binding properties of these bricks. The homogenised groundmass of brick KVP13.16 and the presence of altered bioclasts may suggest that post-depositional alterations occurred, possibly related to a fire event (see Section 5.4; Forget et al. 2015).

Table 4.4 Bricks sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
2a. Red-silty clay loam brick	KVP13.2	Collapsed wall	Area A–SA I/SAVI	342	A
2a. Red-silty clay loam brick	KVP13.3	Collapsed wall	Area B – Room 2a	35	A (?)
2b. Yellow-sandy clay loam brick	KVP13.1	Collapsed wall	Area A – SA III	618	A
2b. Yellow-sandy clay loam brick	KVP13.4	Collapsed wall	Area A – SA IIa	518	A
2b. Yellow-sandy clay loam brick	KVP13.172	Collapsed wall	Area A – SA IIa	2	A
2c. White-silty clay loam brick	KVP13.16	Collapsed wall	Area A – SA III	614	A
2c. White-silty clay loam brick	KVP13.18	Collapsed wall	Area A – SA III	618	A

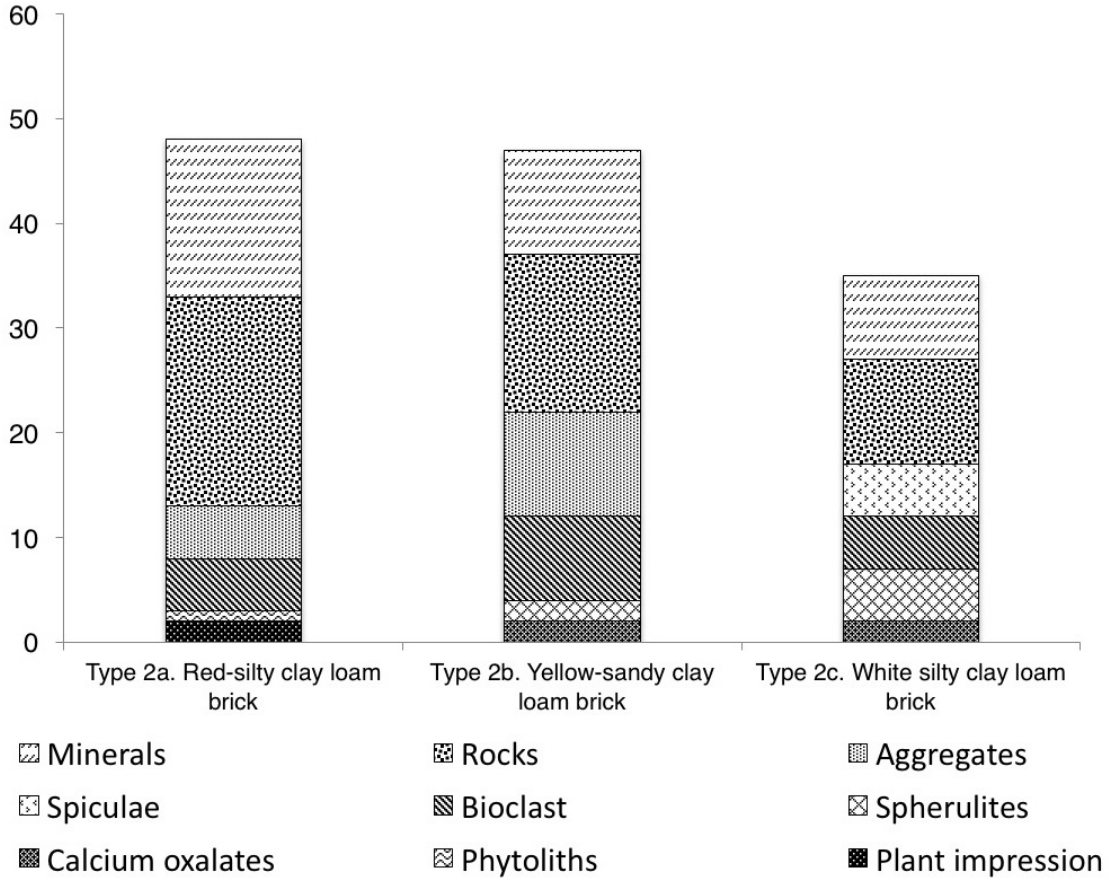


Figure 4.9 Absolute abundance of principal components in brick sub-types 2a, 2b, 2c, obtained calculating the average between percentages of abundance of components in each sample of the three sub-types (e.g. the average between percentages of plant impression in samples KVP13.2 and KVP13.3, of brick Type 2a).

4.4.3 Deposit Type 3. Construction materials: red/brown earthen

Construction materials were identified in the field and distinguished from bricks for their curved-shape, the lower thickness and the presence of post impressions, which suggested that these were possibly roofing structures.

Like bricks, the most characteristic attributes in micromorphological analyses of construction materials were colour, particle size and type and abundance of inclusions (see Table 4.1).

Description: This type comprises red, dark-red/brown sandy clay loam constructional materials with a crystallitic b-fabric, a microstructure characterised by 5% vughs and 5% small cracks and a c/f ratio of 50/50. The principal components embedded in the groundmass are 10% sub-angular/angular igneous rocks, mainly dolerite and basalts of 100µm-5mm, <5% angular/sub-angular limestone of 250µm-1mm, 2-5% sub-rounded chert of 100-500µm, and 15% silty sand size, sub-angular quartz, 2-5% elongated-angular plagioclase, 2% sub-rounded pyroxene and 2% olivine. >5% orange silty clay, silty clay loam sediment aggregates (type 1 and 2) are embedded in the groundmass together with <2% bulliform phytoliths. 2% plant pseudomorphs

shows calcified plant remains, tracheid-like, similar to those observed in red-silty clay loam brick, Type 2a.

Interpretation: *The red/brown sandy clay loam rich in igneous-rock inclusions and sand size quartz possibly suggest that a source similar to that used in red bricks Type 2a was used (Macphail 2008, Wright 1985; 1992). The higher percentage of sand size quartz in this deposit, compared to the lower percentage observed in Red-silty clay laom bricks (Type 2a), may depend on the different depth the sediment was sourced, which can affect particle size and composition of soil, and the possible but not verifiable addition of quartz sands (see Section 5.3.1). Grass phytoliths and plant pseudomorph voids, even if attested in low percentage, may indicate the addition of organic stabiliser, or possibly occurred as natural organic component in the raw material.*

Table 4.5 Construction material, Type 3, in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
3. Construction material: red/brown earthen	KVP14.32	Roofing structure	Area B – Unit 6	106	A
3. Construction material: red/brown earthen	KVP14.29	Roofing structure	Area A – SA VI	647	A

4.4.4 Deposit Type 4. Wall plaster: red/brown earthen

Brown earthen wall plaster were identified in the field in collapsed wall structures, as well as bricks, and distinguished from them for the lower thickness and the traces of red/brown painting on their external surface. These materials were possibly applied on the external face of the wall, to protect the internal mud-brick structures and strengthen the building, and were also used as means for social representation, as attested by the application of red paint (see Section 5.2.3).

Description: This type comprises pale-brown fine sand clay loam wall plaster characterised by a crystallitic b-fabric, a vughy microstructure with a c/f ratio of 50/50. The coarse fraction is mainly characterised by carbonate inclusions as 15% sub-rounded/sub-angular limestone, 5% chert, 10% quartz and 10% bioclasts. <5% fine sandy size igneous rocks (basalts and/or dolerite) are also embedded in the groundmass together with 2% spherulites of 5-10μm, >5% silty clay red-brown aggregates (type 2) and 2% grey silty clay aggregates of type 4.

Interpretation: *The pale-brown colour of this wall plaster type, rich in fossils and limestone inclusions suggests that a soil of B horizon could have been the source of this material. Among the inclusions types, spherulites and rounded sediment aggregates can possibly testify the*

addition of organic and inorganic additive, as dung and clay-plastic soil, to improve cohesion, malleability and tensile strength of the wall plaster. The vughy microstructure may be due to air trapped during the manufacture and possibly attributed to poor pugging (Matthews 2005a; 2005b; Matthews et al. 2013; Macphail and Goldberg 2010, 589-622). The final consideration concerns the surface treatment of these samples, whose upper margins (external area of the wall) are characterised by finer particles (silty-clay size) in comparison to the coarser particles of the core. This evidence suggests that the external surface of these materials was polished or slaked during manufacture. This may be indicative of a preparatory practice to subsequently apply the wash/painting on the wall surface. These samples indeed show a very fine overlying layer of red/brown-clay wash/painting of 40-50μ.

Table 4.6 Wall earthen-plaster, deposit Type 4, in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
4. Wall plaster: red/brown earthen	KVP14.33	Collapsed wall	Area A – SA I	648	A
4. Wall plaster: red/brown earthen	KVP14.30	Collapsed wall	Area A – SA I	693	A

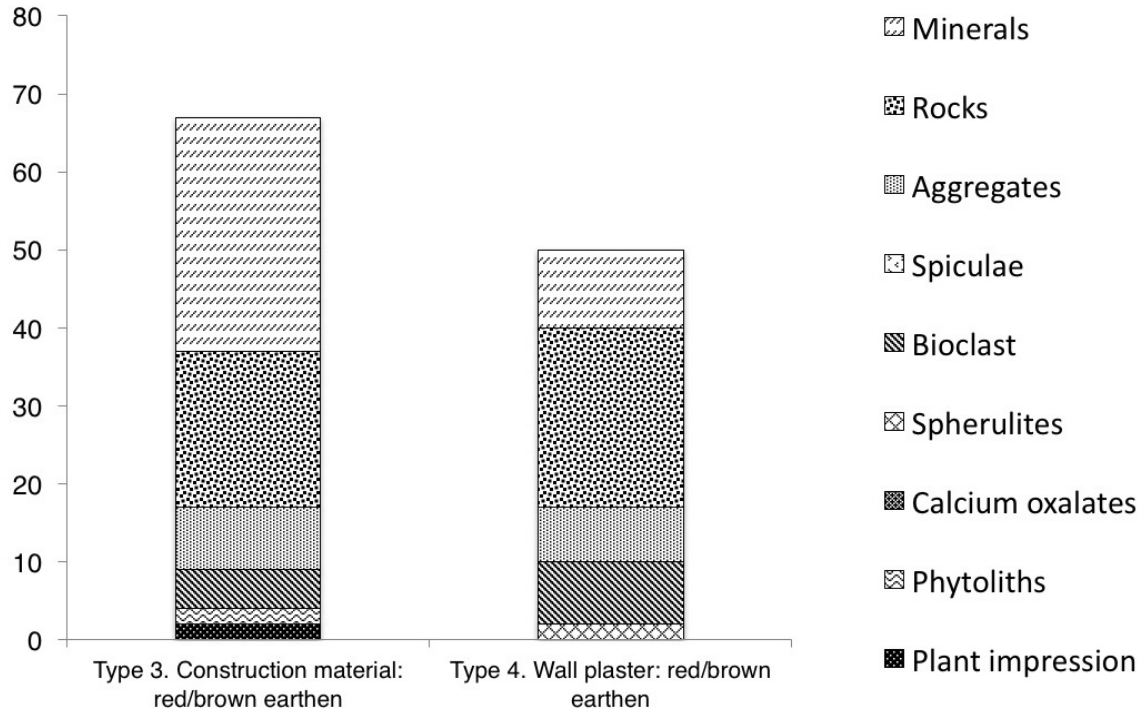


Figure 4.10 Absolute abundance of principal components in constructional material and earthen wall plaster sub-types 3a, 3b, obtained calculating the average between percentages of abundance of components in each sample of the two Types (e.g. the average between percentages of plant impression in samples KVP14.30 and KVP14.33, of earthen wall plaster Type 4).

4.4.5 Deposit Type 5. Wall plaster: white

White wall plaster was identified just in one room, SA III, where the plaster was recovered *in-situ,* applied on the interior face of building-unit SA III. They differ from the previous type for their colour and composition as white wall plaster were produced using a calcite-rich source, possibly marl, instead of an earthen source. These are characterised by colour and composition similar to silty clay plaster floors of Type 9a, as a recurring practice, in Cypriot prehistoric building construction, was to plaster the interior wall and the floor of the room at the same time, using the same material (Fig. 5.15).

Description: White silty clay plaster with crystallitic b-fabric, compact microstructure (<5% vughs), and c/f ratio of 20/80. The coarse fraction is characterised by very few inclusions as 5% silt size sub-rounded quartz, >5% siliceous spicule, of 100-300μm in length, and 2-5% silt size charred particles.

Interpretation: The white colour and fine particles of this wall plaster suggest that a carbonate source was used for its manufacture, possibly the soft marl outcrop, characterised by the presence of sponge spicule (Robertson 1998). The marl deposit, which occurs locally in the settlement area (Pakhna formation), possibly was intentionally chosen as favoured raw material for plaster production, because its binding properties. The presence of spiculae in raw carbonate material indeed may increase the mechanical strength of plasters by providing rigid binding material (Matthews 2010; Gutierrez-Catorena 2010; Stoops at al. 2001). The presence of charred particles may be intentional, to increase the malleability of plaster with organic additives, or accidental, as residues mixed with plaster during the manufacture. It is also possible that charred particles are remains of ashes added as additive, which are not preserved anymore, due to ash diagenesis and secondary calcite formation (Boardman and Jones 1990; Canti 2003).

Table 4.7 Deposit Type 5 in relation to its contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
5. Wall plaster: white	KVP13.8	*In situ* wall (interior)	Area A – SA III	620	B/A

4.4.6 Deposit Type 6. Paint: red

This deposit type is represented by thin layers of 40-100μm, observed on the external surface of earthen wall plaster Type 4.

Description: This type is characterised by a dark-red/brown clay material with undifferentiated b-fabric and <2% of silty size mineral aggregates. These very fine minerals could not be detected through optical observation. SEM-EDX analysis integrated micromorphology

observation through the compositional analysis of these thin layers, which are characterised by calcium carbonate, silicon, aluminium and iron oxide (see Section 5.2.3).

Interpretation: *The dark red-brown colour and the presence of iron oxides suggests that both red ochre or terra-rossa were used for the production of these painting/wash layers. Both these natural pigments are characteristic of the mineralogy of the south-western part of Cyprus (Rapp 2003,461-465; Eastaugh 2004; Ravizza et al. 1999; Kaleda and Krylov 1993).*

Table 4.8 Deposit Type 6 in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
6: Paint: red	KVP14.33	Layer of wash on wall plaster.	Area A – SA VI	648	A
6: Paint: red	KVP13.171	Layer of wash on wall-plaster fragment embedded in a packing.	Area A – SA III	610a	B/A (?)
6: Paint: red	KVP14.30	Layer of wash on wall-plaster.	Area A – SA VI	693	A

4.4.7 Deposit Type 7. Feature mortar

This constructional material was used to bind limestone slabs of structures such as bins and hearths. They are generally a mixture of silty, sandy clay loam and organic and inorganic aggregates. Particle size and colour are the main relevant attributes for their classification (see Table 4.2). Two sub types have been identified:

Type 7a: Feature mortar: pale brown, silty clay loam.

Description: This type comprises pale brown calcareous silty clay loam mortar, with crystallitic b-fabric and a microstructure characterised by 5% small cracks and 5% vughs. The c/f ratio is 30/70. The coarse fraction includes 5% sub-angular, sub-rounded limestone of silt, fine sand size, 2% sub-angular chert, <10% minerals (quartz mainly) together with <10% silty clay orange/pale-brown aggregates (type 1), 5% bioclasts, 2% spicule and 2% charred flecks. 2% plant pseudomorphic voids were also observed.

Interpretation: *The yellowish-brown, silty clay loam soil of this mortar type, similarly to yellow bricks of Type 1b, possibly come from marly calcareous soil, which characterises the geology of middle Kouris river valley (Eaton and Robertson 1993). While limestone, chert and quartz may be residues of the limestone parent material, sediment aggregates of type 2, may represent an intentional addition to provide more cohesion and tensile strength to the yellow, carbonate soil. Plant voids may testify the addition of organic additives during the manufacture (Goldberg and Macphail 2010). The presence of cracks may be connected with shrinkage during the drying process.*

Type 7b: Feature mortar: brown, sandy clay loam.

Description: This mortar is characterised by a brown calcareous sandy clay loam, with crystallitic b-fabric, a microstructure with very few voids (5% vughs, 2%small chambers) and a c/f ratio of 70/30. Angular and sub-angular limestone inclusions of different size, from few microns up to 5mm, are the predominant components (40%). Other inclusion are 15% minerals (mainly quartz), 5% bioclasts, 20% silt size charred particles associated with 5% small charred flecks (100-200µm) and 5-10% calcitic ashes.

Interpretation: *The source material of this mortar type could have been marl/chalk local deposit. The high concentration of limestone inclusions may represent a deliberate addition to prevent cracking breakage for exposure to high temperatures (Wright 2005, 175)*, *as this mortar was applied to bind the limestone slabs of a rectangular hearth*. *The dark colour of this deposit Type is given by the silt-size charred particles embedded in the mortar, possibly resulting from accumulation of soot in the pores of the material.*

Table 4.9 Mortar sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
7a. Silty clay loam mortar	KVP13.20	Squared bin	Area B – Unit 2b	69	A/B
7b. Sandy clay loam mortar	KVP13.19	Limestone hearth	Area A – SA I	383	A

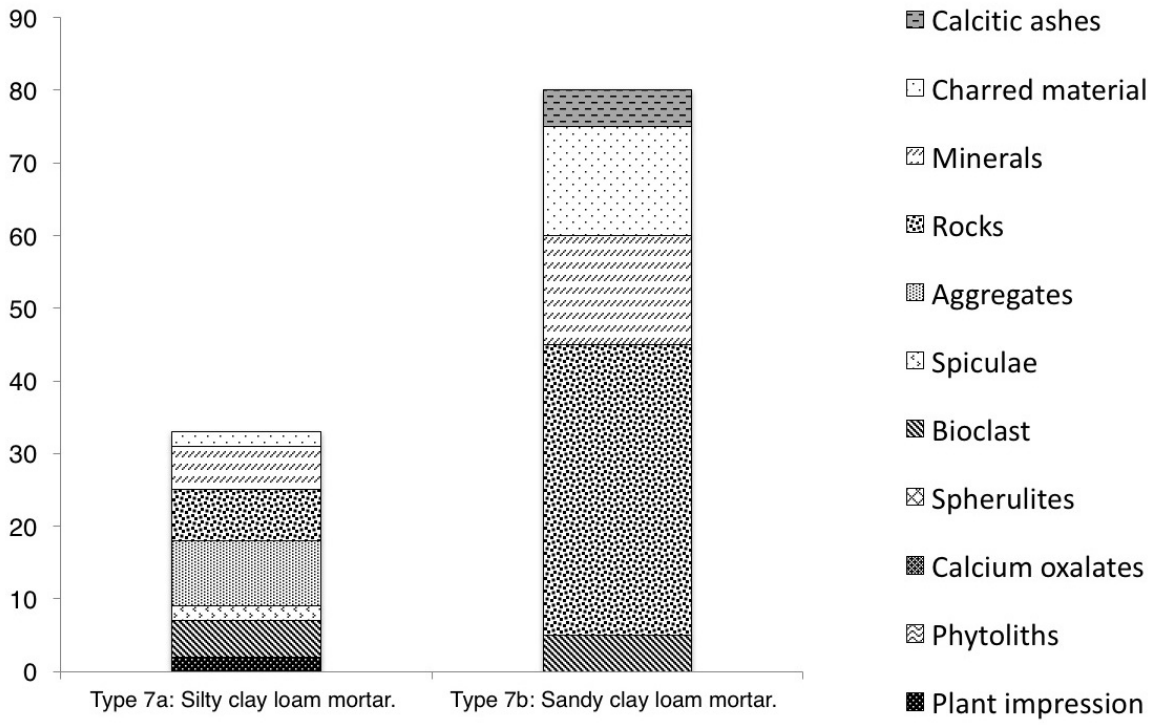


Figure 4.11 Absolute abundance of principal components in mortar sub-types 7a (the values reported in the graph refer to sample KVP13.20), 7b (the values reported in the graph refer to sample KVP13.19).

4.4.8 Deposit Type 8. Feature plaster

The term 'feature plaster' is used to identify plasters, which were used at the site to shape furniture such as hearths and pits and to coat basins. In addition to their different contextual application and use, micromorphological analyses have revealed that they also differ from the plasters applied to walls and floors in their colour, particle size and inclusion types. Two sub-types have been identified and distinguished based on their different source material and inclusion types.

Type 8a: Feature plaster: silty clay with 30% ceramic.

Description: White silty clay loam plasters with crystallitic b-fabric, massive microstructure with few voids (5% cracks and 2-5% elongated vesicles) and c/f ratio of 60/40. The coarse fraction is dominated by >30% silty clay loam, sub-angular/angular ceramic inclusion of different size, from 20μm up to 5-6 mm. ≤15% sub-angular/sub-rounded limestone, 2% rounded chert, 2% subangular-dolerite, <10% minerals (quartz and feldspar) together with 5% bioclasts, mainly foraminifera and 5% sponge spicule are also embedded in the groundmass.

Interpretation: The white colour and particle size of this plaster, together with the presence of very similar limestone inclusions suggest that highly calcitic lime was the material selected for the manufacture of this plaster type, possibly produced by heating the underlying marl/chalk deposits, as attested by the occurrence of altered bioclast (for pyrotechnology of plasters see Section 5.3.3). The abundance of red-brownish silty clay loam aggregates, identified as ceramic inclusions both for their sharp edges and angular shape and for similarities to the ceramic shards analysed, may suggest that these were a deliberate addition to improve the mechanical strength of the final product (Fig. 4.8 e; Philokyprou 2011; Regev et al. 2010; Moropoulou et al. 2005). The presence of elongated vesicles may be attributed to the evaporation of water after compaction, during drying, with the subsequent developing of shrinkage due to desiccation. This could suggest that the material was moderately liquid when applied (Matthews 2005a).

Type 8b: Feature plaster: silty clay loam with 20% limestone.

Description: This yellow/pale-brown silty clay loam plaster is characterised by a crystallitic b-fabric, a vughy microstructure (>10% vughs) and a c/f ratio of 40/60. 15-20% sub-angular, angular limestone inclusion of different size (50μm-1cm), 2% sub-rounded chert, 5% angular quartz of 200-300 μm and >5% bioclasts are embedded in the groundmass together with 2% spherulites of 5-10μm.

Interpretation: *The pale-brown colour of this material suggests that the plaster was possibly prepared mixing the calcareous source with a brown, more plastic sediment, possibly from soil horizon B, without involving any pyrotechnological process, as attested by the presence of sand size limestone and unaltered bioclasts. Limestone sands and angular quartz may represent a deliberate addition to improve the structural properties of this plaster-type and obtain a fire-resistant material (Rice 1987, 94-96; Matthews 2005a, 372; Quinn 2010, 212-221).*

Table 4.10 Feature plaster sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
8a. Feature plaster: silty clay loam with 30% ceramic.	KVP13.5	Circular basin	Area A- SA I	477	B
8a. Feature plaster: silty clay loam with 30% ceramic.	KVP13.6	Circular basin	Area A- SA IIb	443	B
8a. Feature plaster: silty clay loam with 30% ceramic.	KVP13.7	Circular basin	Area A – SA IIa	526	B
8b. Feature plaster: silty clay loam with 20% limestone	KVP13.9	Circular hearth	Area A – SA I	469	B

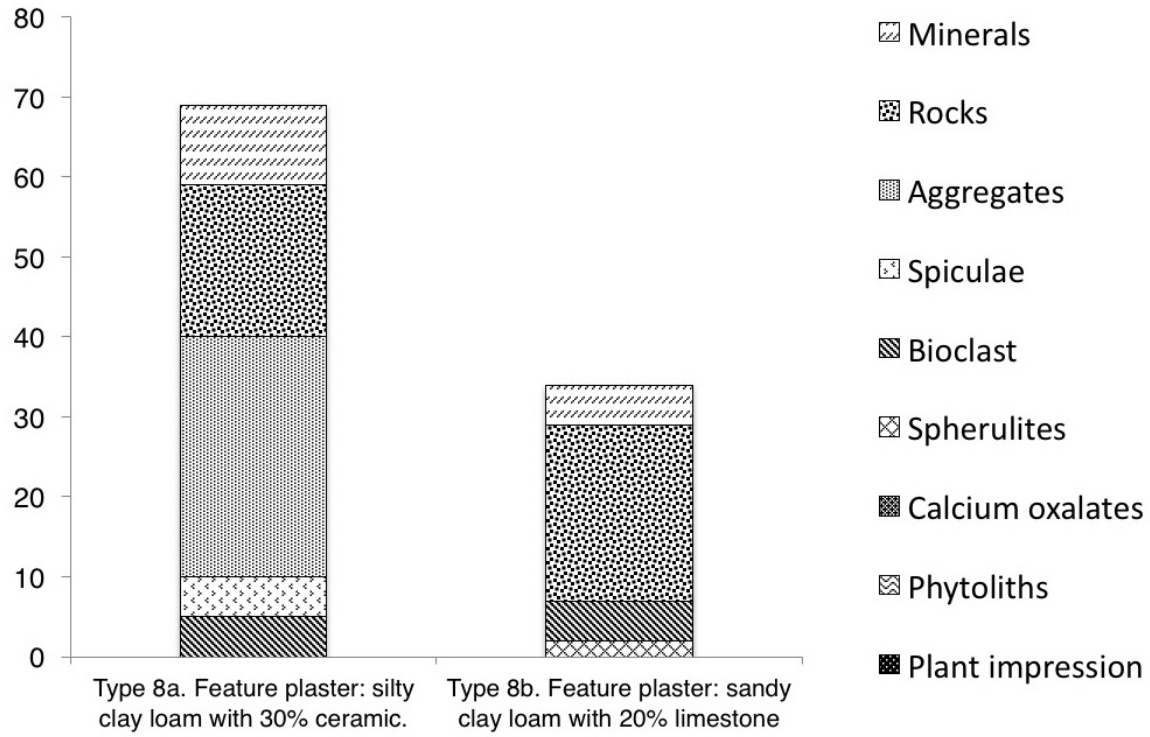


Figure 4.12 Absolute abundance of principal components in feature plaster sub-types 8a, 8b, obtained calculating the average between percentages of abundance of components in each sample of the two sub-types (e.g. the average between percentages of ceramic inclusions in samples KVP13.5, KVP13.6, KVP13.7 of feature plaster Type 8a).

4.4.9 Deposit Type 9. Floor plaster

Consistent co-variation in thickness and particle size was observed and analysed in floor plasters. Thinner floors are 2-5mm thick and were mainly used in reception rooms and smaller spaces. Thicker floors are 50-60mm thick; they were generally laid in working rooms or multifunctional spaces (see Chapter 6 and 7). Plaster floors within each of the context types analysed have similar repeated colour and composition. They may differ within the same sequence or from different areas in particle size, which vary from silty clay to silty clay loam and sandy clay loam. Four sub-types have been identified.

Type 9a: Floor plaster: white, silty clay.

Description: This floor type is characterised by white, silty clay plaster with crystallitic b-fabric and a compact microstructure with <5% vughs and a c/f ratio of 20/80. The characteristic inclusions are 15% spicule, observed both in cross-section (40, 100µm) and in longitudinal section (500µm, 2mm), >5% bioclasts, 5% silt-fine sand size sub-angular limestone and 2% silt-fine sand size sub-rounded chert, 5% silt size sub-angular quartz, 2% calcium oxalates of 20-40µm and 2-5% spherulites of 5µm.

Interpretation: *The fine matrix and the white colour of this floor type suggest that local limestone was the primary source used for this plaster manufacture. The occurrence of sponge spicule in fine floor plasters, as well as in wall plaster, may be significant of the selection of a carbonate deposit more suitable than other available sources for the production of plaster (see also Section 5.2.2). On the basis of optical analysis, which testifies the homogeneity of this plaster and the presence of altered bioclasts, as residual material of fired limestone (Gourdin and Kingery 1975, Kingery et al. 1988) and on the basis of spectroscopic analysis (Chu et al. 2008, Regev et al. 2010), it is possible to presume that these are fired lime plasters, produced by heating calcite-rich material (see Section 5.3.3). No inorganic temper was added to the lime component, as attested by the absence of rocks inclusions, while the addition of organic additives including dung seems to be testified by the presence of calcium oxalates and spherulites; this choice was possibly made in order to produce a more malleable and cohesive material that could be applied in thin layers.*

Type 9b: Floor plaster: buff, silty clay loam.

Description: This plaster floor type is characterised by a buff, silty clay loam, with crystallitic b-fabric, 5% vughs and a c/f ratio of 30/70. The coarse fraction includes <10% sand size limestone and 2% fine-sand size chert, 5% quartz, 2-5% bioclasts, 5% spicule, 5% orange, silty clay aggregates of type 1, 2-5% charred flecks of small size (100-400µm), and >5% spherulites of 5µm scattered in the groundmass.

Interpretation: The source material and manufacture of this plaster floor are similar to the previous floor type. However, this plaster type differs for the occurrence of heterogeneous inclusions, both of inorganic origin as rocks and sediment aggregates and organic origin as charred flecks, and spherulites. These components could possibly be interpreted as deliberate additions to improve the mechanical strength of this plaster.

Type 9c: Floor plaster: pale brown, fine-sandy clay loam

Description: Fine, calcareous sand, pale brown clay loam plaster, with crystallitic b-fabric, 10% vughs and c/f ratio of 40/60. The coarse fraction is mainly characterised by 15% sand-size limestone of 50µm up to 300µm, and 10% quartz, >5% bioclasts and 5-10% silty clay loam aggregates of type 1 and 3.

Interpretation: This floor plaster is coarser than other types due to the presence of limestone sands. The calcareous source was mixed with a brown calcareous sediment, possibly from soil horizons B. It is not certain whether these plaster floors are a pyrotechnological product or they are produced with unfired lime mixed with water (see Section 5.3.3).

Type 9d: Floor plaster: white, sandy clay loam.

Description: Calcareous sandy clay loam white plaster floor with a 'linked and coated' (gefuric) related distribution. The crystallitic fine fraction is calcite-rich while the coarse fraction is composed by 30% limestone sand of different size, from 100µm to 5mm. 5% quartz and 5-10% bioclasts are also occurring together with 2% sediment aggregates of type 1 and 2, and 2%charred flecks of 500µm-2mm.

Interpretation: The absence of spicule in this floor plaster suggest the use of a different carbonate source. Differently from the first two plaster sub-types, which were presumably fired, this one seems to have been produced crushing limestone, possibly discarded from building/carving activities and mixing it with water (Wright 2005, 147). This hypothesis has been suggested by micromorphological observations, which indicate the material has a 'linked and coated' (gefuric) related distribution, with limestone sands coated by secondary calcite, possibly formed by reaction of carbonate component (crushed limestone) in contact with water, mixed to it during the manufacture (Durand et al. 2010, 149-182). Spectroscopic result supported this hypothesis, showing how values recorded in this plaster sub-type are similar to those recorded in local limestone samples, suggesting that this floor was not fired (see 5.3.3). Charred flecks as well as sediment aggregates, which occur in very small percentages, may possibly be considered accidental inclusions.

Table 4.11 Floor plaster sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
9a. Floor plaster: white, silty clay	KVP13.10	Small productive room	Area A – SA IIa	532	A
9a. Floor plaster: white, silty clay	KVP13.21	Small entrance	Area A – SA IIb	444	A
9a. Floor plaster: white, silty clay	KVP14.2.II	Wide reception space (?)	Area A – SA VI	681a	A1
9b. Floor plaster: buff, silty clay loam	KVP13.11	Small entrance	Area A – SA IIb	435	B
9b. Floor plaster: buff, silty clay loam	KVP14.2.II	Wide reception space (?)	Area A – SA VI	681c	A1
9c. Floor plaster: pale brown, fine sandy clay loam	KVP13.15	Wide working room	Area A – SA I	360	A
9c. Floor plaster: pale brown, fine sandy clay loam	KVP13.12	Small working room	Area A – SA IIa	530	B
9c. Floor plaster: pale brown, fine sandy clay loam	KVP13.13	Domestic space	Area B – Room2	71	A
9c. Floor plaster: pale brown, fine sandy clay loam	KVP14.5	Wide working room	Area A – SA I	461	B
9c. Floor plaster: pale brown, fine sandy clay loam	KVP13.14	Wide working room	Area A – SA I	461	B
9d. Floor plaster: white, sandy clay loam	KVP14.2.II-II	Wide clean space	Area A – SA VI	697	A2

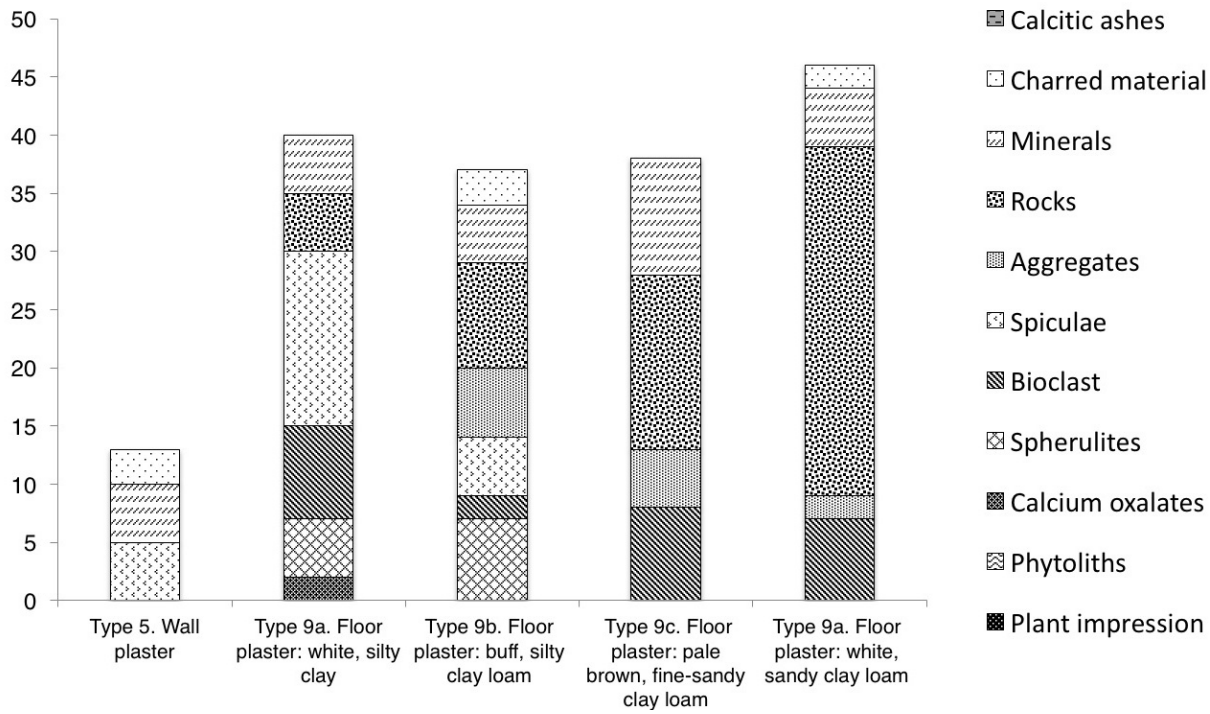


Figure 4.13 Absolute abundance of principal components in wall plaster Type 5 and floor plaster sub-types 9a, 9b, 9c, 9d. The abundance of components in floor plaster types was obtained calculating the average between percentages of abundance of components in each sample of the four sub-types (e.g. the average between percentages of spicule observed in samples KVP13.10, KVP13.21, KVP14.2.II, plaster floor Type 9a).

4.4.10 Deposit Type 10: Constructional packing

The interpretation of this deposit type as 'constructional packing' was based on field/stratigraphic observation and micromorphological observations on occurrence and abundance of components and their random orientation and distribution (Matthews *et al*. 1997). Constructional packings analysed at Erimi-Ltp differ from plaster floors for their darker colour, generally brown, and their heterogeneity. Packings were made reusing discarded materials and occupations deposits and, therefore, include a mixture of sediment aggregates, architectural material debris and charred matter. Two types have been identified, due to their differences in colour and component types.

Type 10a: Constructional packing*: *pale brown, silty-sandy clay laom

Description: Pale-brown/brown silty to sandy-clay-loam characterised by crystallitic b-fabric, a vughy microstructure and a c/f ratio of 40/60. Heterogeneous components are embedded in the groundmass as >10% angular, sub-angular rock inclusion of different size (from few microns up to 1mm), mainly limestone, more rarely sub-rounded chert and angular dolerite, 10% minerals, predominantly quartz and plagioclase, 5-10% bioclasts and 2-5% sponge spicule. Local lenses of calcitic ashes were also observed together with 5% charred flecks and silty size charred material, >5% sediment aggregates of type 1 and 3, architectural material debris as red-bricks (2%), plaster (>5%) and natural 3-5mm marl fragments (2-5%).

Interpretation: The heterogeneity of this deposit type suggests that a wide range of materials, mainly of inorganic origin, were used in the construction of these sub-floor packings. Possibly calcareous soil, rich in limestone inclusions, which is easy source to procure in the middle Kouris Valley area (Jacobs et al. 2010), was mixed with discarded or/and degraded materials as attested by the presence of lenses of ashes and architectural debris. These heterogeneous components were possibly selected and mixed together to improve the structural stability and mechanical strength of these constructional packings (Matthews 2005a).

Type 10b: Constructional packing with 40% charred material.

Description*:* This packing type is characterised by calcareous sand, dark brown clay loam with crystallitic b-fabric, a vughy microstructure and c/f ratio of 40/60. The groundmass is dominated by 30% sand size angular, sub-angular limestone inclusions and 20-30% charred materials, which occur as silty size charred particles mixed with <10% calcitic ashes and >5% disarticulated phytoliths. 5-10% sub-angular quartz, 5-10% bioclasts, 2-5% calcium oxalates crystals of 40 µm, 2% spherulites of 5µm., 2-5% constructional material debris and a big lump of plaster of 1,5-2 cm were also observed.

<u>Interpretation</u>: The organic content of this packing associated with the abundance of charred material and calcitic ashes, suggests that the primary source of this packing could have been discarded/raked-out material, possibly from a fire installation, which were re-used as ground-raising constructional material (Shahack-Gross et al. 2005; Macphail and Goldberg 2010, 592-595). Heterogeneous organic material as ashes, charred matter and phytoliths confirm this hypothesis, suggesting that these materials were possibly primarily used as fuel in the nearby hearth, and secondary used as packing.

Table 4.12 Constructional packing sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
10a. Constructional packing: pale brown, silty-sandy clay laom	KVP14.2.II	Wide roofed space	Area A – SA VI	696	A2
10a. Constructional packing: pale brown, silty-sandy clay laom	KVP14.4.I	Wide roofed space	Area A – SA VI	728b	postB
10a. Constructional packing: pale brown, silty-sandy clay laom	KVP13.171	Roofed room	Area A – SA III	610b	A
10a. Constructional packing: pale brown, silty-sandy clay laom	KVP14.3	Wide roofed space	Area A - SA VI	698	B/A
10b. Constructional packing with 40% charred material.	KVP14.5	Wide roofed room	Area A – SA I	459	B

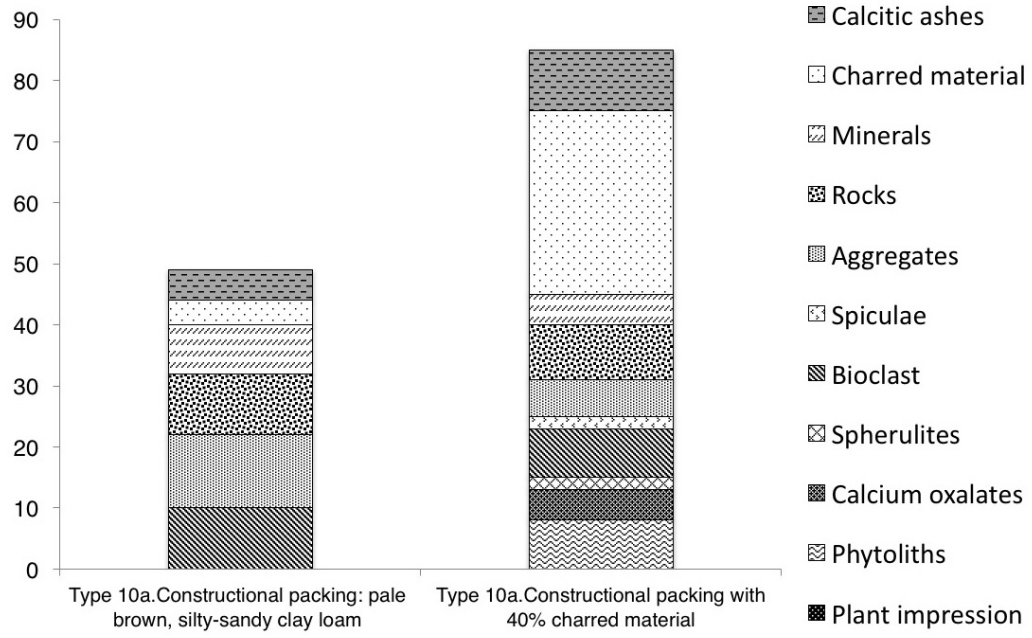


Figure 4.14 Absolute abundance of principal components in constructional packing sub-types 10a, 10b, obtained calculating the average between percentages of abundance of components in each sample of the two sub-types (e.g. the average between percentages of rock inclusions in samples of Type 10a).

4.4.11 Deposit Type 11: Occupation deposit

Very few deposits were identified and characterised as 'occupation deposits' at Erimi-LtP. The scarce occurrence of primary activity residues at Erimi-LtP may be connected to the observed socio-cultural practice of maintaining the surfaces cleaned (Matthews 2005a; 2005b). In addition, the burial process, which is a key element for the preservation of primary residues on floors (Friesem at al. 2014), and the compacted plaster floor types used to pave the room space that capture less residues than porous and unconsolidated ones (La Motta and Schiffer 1999), possibly influenced the scarce preservation of primary residues of occupation on the floors analysed.

Microscopically, the occupation deposits, have been classified on the basis of their colour and inclusions. Two sub-types have been identified.

Type 11a: Occupation deposit: sandy clay loam

Description: Orange calcareous sandy clay loam matrix characterised by a crystallitic b-fabric, a vughy microstructure with few packing voids (2%) and a c/f ratio of 40/60. The main inclusion types are represented by sub-angular, sub-rounded limestone of different size, 100µm, 3-4mm (<10%) and 5% rounded sediment aggregates of type 1.

Interpretation: This type, represented just by one deposit, is characterised by a clay loam very similar to the alluvial sediment used in bricks Type 2a, but mixed with calcareous sediment and sand. Because the proximity to a wall structure, it is possible that this deposit could have been originated by bricks degradation, possibly caused by rainwater, which washed the mud down the wall, and/or by wind abrasion and deposition, and accumulated during occupation. This hypothesis is supported by the presence of clay coatings, which could suggest a wet grain flow of bricks debris and by rounded sediment aggregates, which could represent abraded wall bricks debris transported by wind and mixed to the orange silty clay sediment (Friesem et al. 2011, 2014). In addition, the sorted grain-size distribution of these rounded aggregates, suggested that this deposit was possibly swept and dumped in a corner of the room space (Miller et al. 2010).

Type 11b: Occupation deposit: silty clay loam with 5% charred material.

Description: This deposit type comprises grey silty clay loam, with crystallitic b-fabric and vughy microstructure and c/f ratio of 30/70. The principal component embedded in the groundmass are >5% of charred material particles of 20,150µm, scattered in the groundmass. Fragments of constructional materials are occasionally embedded in the groundmass (<2%).

Interpretation: The presence of charred silt size particles, especially in thin deposit as KVP14.2.II/681b, may be interpreted as dusty residues deposited on the floor surface during the occupation (Schiffer 1987; Golberg and Macphail 2006, 212-216). In other cases, as the pit fill KVP14.4/728a, the charred particles embedded in a grey, calcareous deposit, may be interpreted as residual material of activities, which possible involved the use of fire or discarded charred residues from hearths (e.g the use of ash to wash wool, according to interpretation of archaeologists; Muti 2015, 190-200).

Table 4.13 Occupation deposit sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
11a. Occupation deposit: sandy clay loam	KVP14.2.I	Wide clean space	Area A – SA VI	698	B
11b. Occupation deposit: silty clay loam with 5% charred material	KVP14.2.II	Wide clean space	Area A – SA VI	681b	A1
11b. Occupation deposit: silty clay loam with 5% charred material	KVP14.4	Wide clean space	Area A – SA VI	728a	B
11b. Occupation deposit: silty clay loam with 5% charred material	KVP14.4	Wide clean space	Area A- SA VI	689	A2

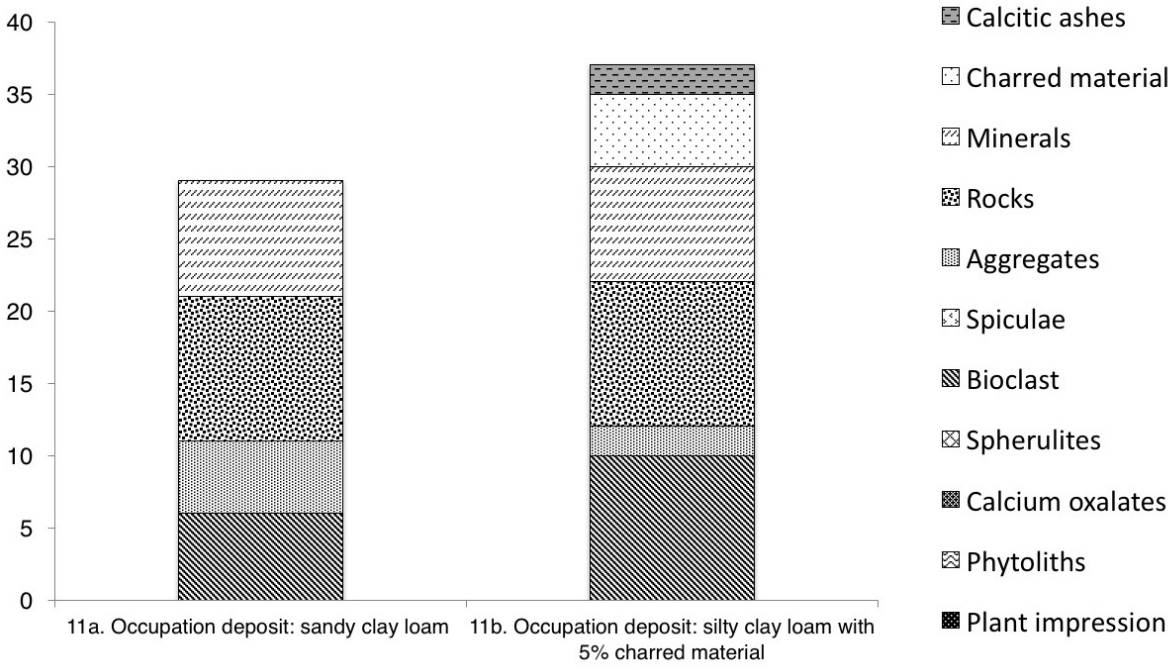


Figure 4.15 Absolute abundance of principal components in occupation deposit sub-types 11a, 11b, obtained calculating the average between percentages of abundance of components in each sample of the two sub-types (e.g. the average between percentages of rock inclusions in samples of Type 11a).

4.4.12 Deposit Type 12: Destruction deposit

Destruction deposits have been identified by their stratigraphic location in exposed sections and sequences beneath the collapsed wall deposits, mainly composed by limestone blocks mixed with bricks, plaster debris and red-brownish sandy-clay loam. Two sub-types have been identified on the basis of their colour and inclusions.

Type 12a. Destruction deposit: dark-brown

Description: This deposit type is characterised by dark-brown, sandy clay loam with, crystallitic b-fabric, a microstructure dominated by vughs (20%) and c/f ratio of 40/60. Sub-angular, sub-rounded limestone, represent the main inclusion type (>20%), mixed to 20% charred particles of 20-700µm, 5% calcitic ashes, >5% sediment aggregates of different origins, mainly of type 1 and 5% constructional materials.

Interpretation: These dark brown deposits, which were observed in association with collapsed wall structures, may possibly represent roof and/or wooden supporting structures collapsed and partially mixed to other debris, mainly calcareous (see Chapters 6 and 7 for a detailed discussion of this deposit type in relation to their spatial and stratigraphic context, Friesem et al. 2014).

Type 12b. Destruction deposit: orange/brown

Description: This deposit type is characterised by orange/pale brown, sandy clay loam, with crystallitic b-fabric and a vughy microstructure and a c/f ratio of 40/60. The coarse fraction is dominated by >20% limestone inclusions, 10% sediment aggregates of types 1, 2, 3 and > 10% architectural material debris as bricks and cobbles of plasters.

Interpretation: The orange/brown colour of this deposit type could be interpreted as produced by degradation of brick and plaster walls materials. These thick layers (2-4cm) were observed mixed with charred destruction deposit (Type 10a). Plaster fragments similar to deposit-Type 5 and 9a, are sometimes mixed with the orange sandy clay loam and possibly pertaining to wall plasters. In one case (KVP14.1/685b) a fragment (1 cm) of possible wall plaster sequence with micro-layers of red painting/wash has been recorded.

Table 4.14 Destruction deposit sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
12a. Destruction deposit: dark brown	KVP14.7	Roofed room	Area A – SA IIa	448	Post A
12a. Destruction deposit: dark brown	KVP13.172	Roofed room	Area A – SA IIa	448	Post A
12a. Destruction deposit: dark brown	KVP14.1	Wide clean room	Area A – SA VI	688	Post A
12b. Destruction deposit: orange/brown	KVP14.2.II	Wide roofed space	Area A – SA VI	643	Post A
12b. Destruction deposit: orange/brown	KVP14.1	Wide roofed room	Area A – SA VI	685b	A1
12b. Destruction deposit: orange/brown	KVP14.4.II	Wide roofed room	Area A – SA VI	685	A

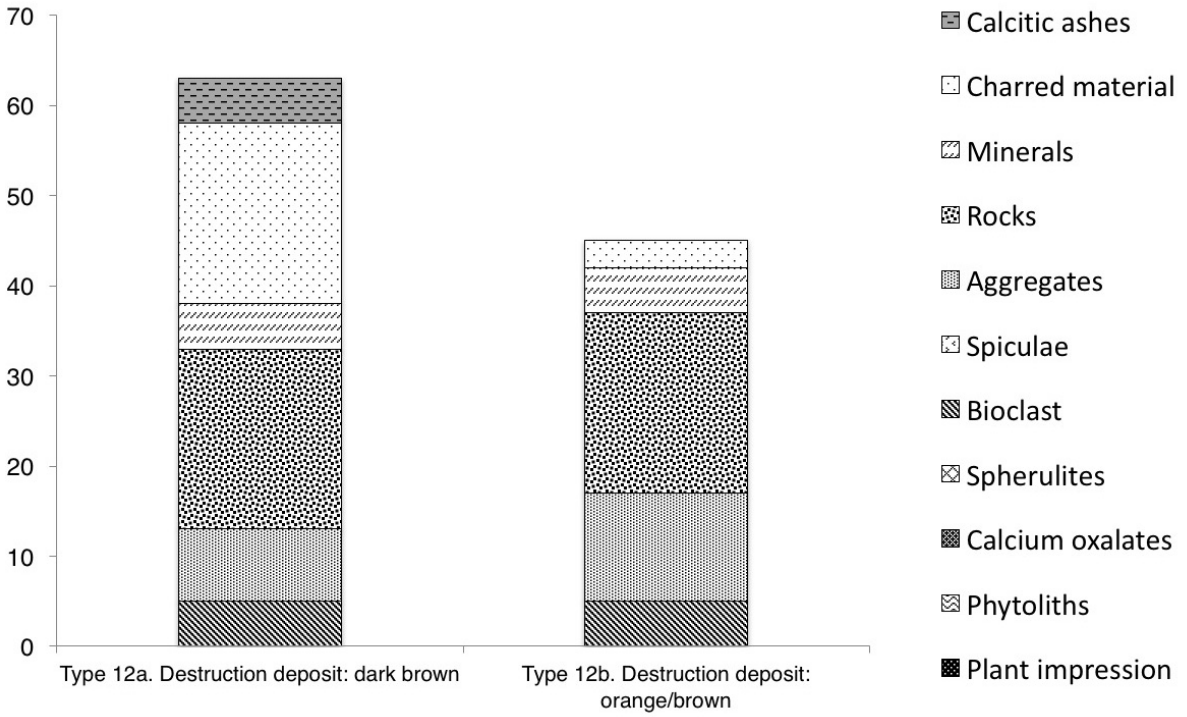


Figure 4.16 Absolute abundance of principal components in destruction deposit sub-types 12a, 12b, obtained calculating the average between percentages of abundance of components in each sample of the two sub-types (e.g. the average between percentages of rock inclusions in samples of Type 12a).

4.4.13 Deposit Type 13: Ceramic pottery

This category is normally distinct from a classification of deposits *sensu stricto,* but it has been added as comparison to other earthen materials, to study similarities and possible differences in provenance and manufacturing techniques and scale of production. The four samples analysed have been selected because they pertain to two key productions of the area, Red

polished Ware and Drab Polished Ware, identified on the basis of their stylistic and compositional attributes as 'local production' (Webb pers. comm.). Four types have been analysed.

Type 13a. Sandy clay loam Drab-Polished Ware.

Description: Brown-orange silty clay loam with a dark-brown core, speckled/crystallitic b-fabric, compact microstructure characterised by few voids (<5% vughs) and a c/f ratio of 50/50. The coarse fraction is characterised by moderately sorted igneous (20%) and sedimentary (2-5%) rocks, mixed to 15-20% minerals, especially sub-angular quartz and elongated angular feldspar of plagioclase family 2-5% rounded aggregates of type 2 are also present. The coarser materials are oriented with the surface of the pot, and finer rocks and mineral inclusions were observed along the surfaces, while coarser inclusions characterise the core.

Interpretation: *The sample analysed is characteristic of the Drab polished ceramic type, with a distinctive darker core and an orange-brown surface (Frankel and Webb 2012a, 2). Colour, particle size and inclusion types are very similar to red-bricks Type 2a and construction materials Type 3, however the low percentage of carbonate rocks, which occur as principal component in terra-rossa/fusca deposits, suggests that another source, possibly of alluvial origin was selected for this ceramic production. The presence of moderately sorted sub-angular sands could suggest the addition of inorganic temper; however, this hypothesis is not verifiable, and sandy inclusions may also be natural inclusions of the raw material. The occurrence of finer particle close to the surfaces on the pot and coarser ones in the core, and their parallel orientation with the pot surface may be attributed to manufacturing practice and in particular to the polishing of the surface, which is a process attested for this ceramic production (Dikomitou 2007; 2012; Frankel and Webb 2012a; Quinn 2013). The presence of dark brown core in comparison with the brown-orange colour of the surface suggests that the firing temperatures were not high enough or were not kept high for long enough to endure a complete oxidation (Dikomitou 2012, 174; Quinn 2013, 188-203).*

Type 13b. Silty clay Drab-Polished ware with fine inclusions.

Description: This type is characterised by orange, sorted silty clay, with a grey core, speckled b-fabric, a microstructure with 5% vughs and 2-5% cracks parallel oriented to the surface of the pot, a c/f ratio of 20/80. 10% quartz and 5% feldspar are the main inclusions, and are particularly clustered in one area of the sample. 2% rounded red clay, silty clay (20µm-1mm) are also embedded in the groundmass. As well as the previous ceramic type, finer particles occur along the margins of the pot while coarser ones in the core.

Interpretation: *This ceramic type was possibly manufacture mixing together different clay types as confirmed by a poorly mixed area of the sample, where a red-brown silty-clay of possible alluvial origin, with major concentration of feldspars, is mixed to a calcareous silty clay. Manufacture and firing condition seems to be similar to the previous ceramic type.*

Type 13c. Sandy clay loam Red-Polished ware.

Description: Red-brownish sandy clay loam, characterised by moderately sorted igneous rocks (20%), parallel oriented to the surface of the pot. The microstructure is characterised by <10% vughs and 2% pseudomorphic void, the c/f ratio is 50/50, and the b-fabric is crystallitic. 2% limestone, 15-20% minerals as sand-size quartz, plagioclase, pyroxene and muscovite together with 2% rounded red silty clay aggregates of type 2 are embedded in the groundmass. A red-clay layer of 40-50µm was observed on the internal and external surfaces of the pot.

Interpretation: Red Polished Ware is the most attested production in Bronze Age Cyprus and it is characterised by a red-dark orange colour, both on the polished surface and on its internal matrix (Frankel and Webb 2012; Dikomitou 2012). The sample analysed belong to Red-polished type and was possibly made using alluvial sediment. This hypothesis may be sustained by the small percentage of calcareous component both in the fine and coarse fraction and the abundance of igneous rocks, which were transported and deposited by water from the volcanic outcrops of Troodos Mountain (*Lagroix and Borradaile 2000). The presence of planes possibly testifies the addition of plant temper. Differently from the previous types, the homogenous colour of the sample suggests that the pot was fired under an oxidised atmosphere (Quinn 2013, 188-203; Davit et al. 2014).*

Type 13d. Silty clay Red-Polished ware.

Description: This sample is characterised by an orange, calcareous, well sorted silty-clay, with striated b-fabric, a compact microstructure with 5% cracks parallel oriented to the surface and a c/f ratio of 30/70. <10% bioclasts and 5% siliceous sponge spicule characterise the coarse fraction together with 5% rounded red clay aggregates of 10-100µm. 2% limestone sub-rounded silty-size inclusions of 200-700µm and 1% of sub-angular dolerite are also embedded in the groundmass mixed to >5% quartz and muscovite. A red-clay layer of 20µm was observed on top of one of the pot surface.

Interpretation: The abundance of calcareous component in this type and the presence of spicule suggest that a calcareous source was the principal sediment used for this ceramic production, possibly mixed to an iron-rich silty clay of alluvial origin. Manufacture and firing are similar

to Types 13b and 13c. The presence of cracks parallel to the pot surfaces may be related to shrinkage during drying process (Quinn 2013, 185-188).

Table 4.15 Ceramic sub-types in relation to their contextual space, stratigraphic unit and chronological phase.

Deposit-type	Sample	Context type	Location	Unit	Phase
13a. Sandy clay loam Drab-Polished Ware	KVP13.26	Small productive room	Area A – SA IIa	448	A
13b. Silty clay Drab-Polished Ware	KVP13.25	Funerary context	Area E – T.448	4	-
13c. Sandy clay loam Red-Polished Ware	KVP13.27	Wide roofed room	Area A – SA III	618	A
13d. Silty clay Red-Polished Ware	KVP13.28	Funerary context	Area E – T.248	4	-

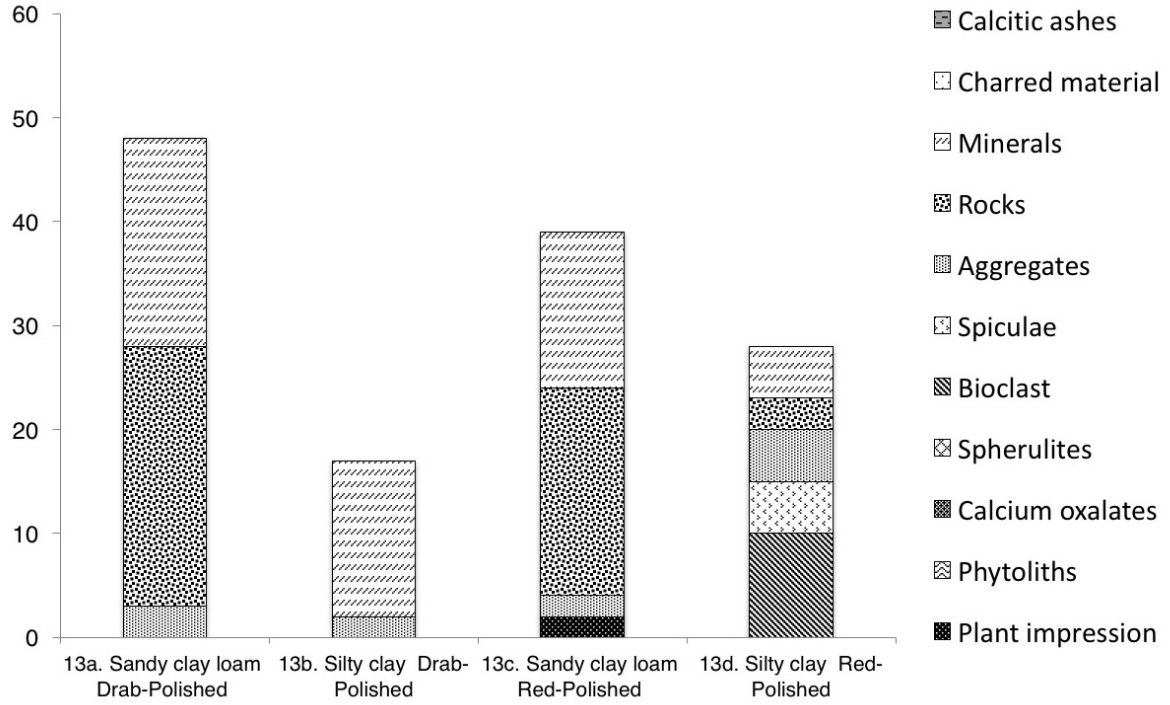


Figure 4.17 Absolute abundance of principal components in ceramic sub-types 13a, 13b, 13c, 13d. The values were calculated on the basis of recorded percentages of abundance of components in each sample.

5. ARCHITECTURAL MATERIALS AND TECHNOLOGY

5.1 Introduction

This chapter examines the results obtained from the multi-proxy analysis of architectural materials that were recovered, sampled and preliminary studied in the field and further analysed by the integration of micromorphology with spectroscopic and geochemical analyses. The resulting evidence are examined in this chapter to investigate the first set of aims of this research: the study of architectural materials, manufacture and placement as indicator of technological and socio-cultural choices in the selection and transformation of materials for architectural surfaces and installations (Matthews *et al*. 2013; Lemonnier 1993; Ingold 2000; Love 2013), and the analysis of the role of architectural materials in the creation of social, cultural and political settings and relationships within buildings and communities associate with them (Matthews 2005; Parker Pearson 1994; Bouridieu 1990; Asatekin 2005).

The chapter examines different themes, starting from the analysis of environmental resources and raw materials procurement (Section 5.2) to manufacture practices and techniques of mudbricks and earthen construction materials, lime-plaster types and stone (Section 5.3). A brief section aimed at analysing post depositional alterations of earthen construction materials, using FTIR spectroscopy, has been included in this chapter to integrate micromorphological results examined in Section 4.3, in order to support the reconstruction of post-depositional agencies, which caused the destruction of settlement structures (Section 5.4). The main chapter themes are briefly discussed in Section 5.5. to reconstruct the social, cultural and economic organisation of Middle Bronze Age community of Erimi-LtP; these themes will be then more broadly discussed in Chapter 8 to examine the development of recent Cypriot prehistory and the increasing social complexity during Middle Bronze Age Cyprus (see Sections 1.3, 1.4).

A total of 50 samples have been analysed by means of micromorphological analysis of thin-sections and spectroscopic and geochemical analyses of bulk samples. The study-samples include 32 architectural materials, and 7 ceramic sherds and 11 natural sediments as comparative materials to study procurement and selection of natural resources. Table 5.1 illustrates the samples studied, indicating specific techniques used.

Table 5.1 Samples studied by microscopic and geochemical analyses, indicating techniques used.

Sample no.	Area	Building	Context and deposit	Micromorph	Bulk FTIR	Bulk XRF	SEM EDX
KVP13.1	A	SA III	Mudbrick - Type 2b	x	x	x	
KVP13.2	A	SA I/VI	Mudbrick - Type 2a	x	x	x	
KVP13.3	B	Unit 2a	Mudbrick - Type 2a	x	x	x	
KVP13.4	A	SA IIa	Mudbrick - Type 2b	x	x	x	
KVP13.172	A	SA IIa	Mudbrick - Type 2b	x	x	x	
KVP13.16	A	SA III	Mudbrick - Type 2c	x	x	x	
KVP13.18	A	SA III	Mudbrick - Type 2c	x	x	x	
KVP13.29	B	Unit 2b	Construction material- Type 3	x	x	x	
KVP13.32	A	SA VI	Construction material- Type 3	x	x	x	
KVP13.30a	A	SA I	Earthen wall plaster -Type 4	x	x	x	
KVP13.33a	A	SA I	Earthen wall plaster-Type 4	x	x	x	
KVP13.30b	A	SA I	Painting layer - Type 6	x			x
KVP13.33b	A	SA I	Painting layer - Type 6	x			x
KVP13.171	A	SA III	Painting layer - Type 6	x			x
KVP13.8	A	SA III	Lime wall plaster - Type 5	x	x	x	
KVP13.20	B	Unit 2b	Lime-Mortar - Type 7a	x	x	x	
KVP13.19	A	SA I	Lime-Mortar - Type 7a	x	x	x	
KVP13.5	A	SA I	Feature plaster – Type 8a	x	x	x	
KVP13.6	A	SA IIb	Feature plaster – Type 8a	x	x	x	
KVP13.7	A	SA IIa	Feature plaster – Type 8a	x	x	x	
KVP13.8	A	SA I	Oven plaster – Type 8b	x	x	x	
KVP13.10	A	SA IIa	Floor plaster – Type 9a	x	x	x	
KVP13.21	A	SA IIb	Floor plaster – Type 9a	x	x	x	
KVP14.2.681a	A	SA VI	Floor plaster – Type 9a	x	x	x	
KVP13.11	A	SA IIb	Floor plaster – Type 9b	x	x	x	
KVP13.2.681c	A	SA VI	Floor plaster – Type 9b	x	x	x	
KVP13.15	A	SA I	Floor plaster – Type 9c	x	x	x	
KVP13.12	A	SA IIa	Floor plaster – Type 9c	x	x	x	
KVP13.13	B	Unit 2a	Floor plaster – Type 9c	x	x	x	
KVP14.5.461	A	SA I	Floor plaster – Type 9c	x	x	x	
KVP13.14	A	SA I	Floor plaster – Type 9c	x	x	x	
KVP14.2.697	A	SA VI	Floor plaster – Type 9d	x	x	x	
KVP13.26	A	SA IIa	Ceramic sherd-Type 13a	x	x	x	x
KVP13.25	E	T.448	Ceramic sherd-Type 13b	x	x	x	x
KVP13.27	A	SA III	Ceramic sherd-Type 13c	x	x	x	x
KVP13.28	E	T.248	Ceramic sherd-Type 13d	x	x	x	x
KVP13.34	E	T.448	Ceramic sherd-Type 13b		x	x	
KVP13.35	A	SA III	Ceramic sherd-Coarse ware		x	x	
KVP13.37	A	SA I	Ceramic sherd-Coarse ware		x	x	
KVP16.1	North of Area A		Weathered marl soil		x	x	
KVP16.2	North of Area A		Weathered marl soil		x	x	
KVP16.3	North of Area A		Weathered marl soil		x	x	
KVP16.4	North of Area A		Weathered marl soil		x	x	
KVP16.5	South terraces		Pale brown soil-horizon B		x	x	
KVP16.6	3 km from the site		Terra-fusca		x	x	
KVP16.7	2 km from the site		Terra-fusca		x	x	
KVP16.8	5 km from the site		Terra-rossa		x	x	
KVP13.22	Settlement area		Soft *havara*	x	x	x	
KVP13.23	Settlement area		Marl	x	x	x	
KVP13.24	Settlement area		*Kafkalla*	x	x	x	

5.2 Environment and architectural material provenance

The study of material procurement was conducted by the collection and analysis of diverse architectural material samples and selected natural sediments. 32 architectural material samples were selected from the proposed productive Area A and residential Area B of the settlement. 11 natural sediment samples were collected within the range of 5 km from the site, based on ethnographic observations that suggest that the catchment area is generally at few kilometres from the site of production, as workers do not travel significant distances to obtain their raw materials (Quinn 2013, 117-119; Norton 1986).

Micromorphological analysis of thin-sections were coupled with IR spectroscopy and XRF analysis of bulk sub-samples in order to study chemical and mineralogical composition of mud-bricks, earthen construction materials (5.2.1) and lime-plasters types (5.2.2), and to integrate micromorphological results, which are discussed in Chapter 4 and are fully presented in Appendix C. The aim is to characterise raw materials chosen in architectural material manufacture, to assess dynamics related with land use and soil procurement (Goldberg 1979; Nodarou *et al*. 2008) and possibly to identify the production choices as means for social representation and communication (Love 2012; 2013a). Micro-chemical analysis, using SEM-EDX were further applied to characterise red painting layers recovered on wall surfaces and to obtain data about elemental composition of pigment used (5.2.3; Damiani *et al*. 2003; Anderson *et al*. 2014a; Quintana *et al.* 2015).

5.2.1 Composition and provenance of mud-bricks and earthen construction materials

Mud-bricks and earthen construction materials were collected during the five excavation campaigns (2009-2014) and preliminary analysed in the field, during the fieldwork seasons 2013-2014. Natural sediments were collected and analysed during 2016 fieldwork campaign.

Seven mud-brick**,** two earthen construction materials, possibly from roofing structures, and two earthen wall plaster samples have been selected for this study because more intact and better preserved. Eight natural sediments pertaining to different local deposit types have been used as comparative materials to analyse the selection and use of different local resources in the production of architectural materials. The natural sediments selected for this study include four samples of weathered marl soil (Fig. 5.1 a); one samples of pale-brown calcareous soil from horizon B (Fig. 5.1 b); two samples of brown soil overlying the caliche outcrop, terra-fusca soil (Fig. 5.1 c); one samples of red soil overlying the caliche outcrops, terra rossa soil (Fig. 5.1 d).

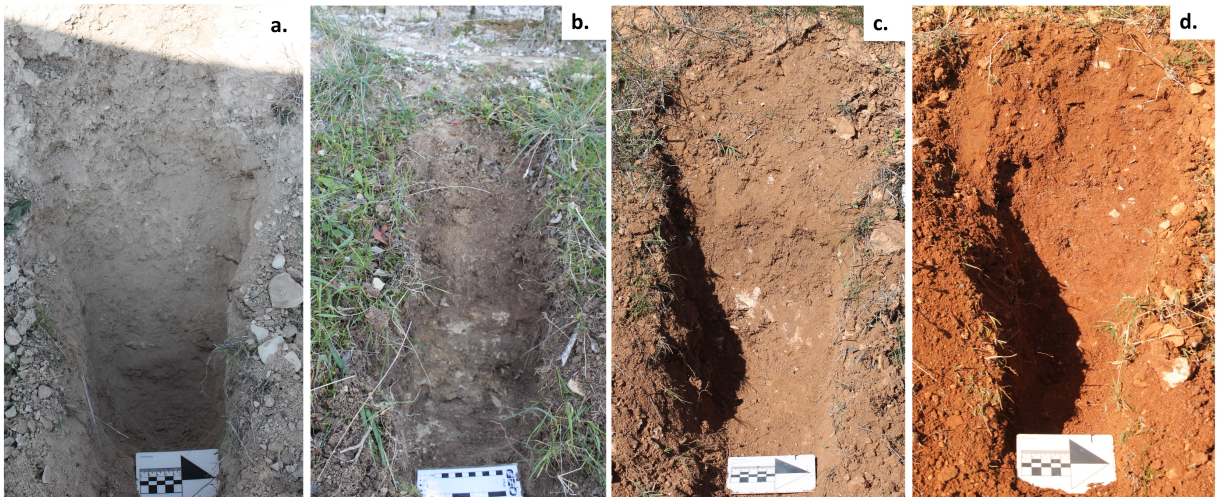


Figure 5.1 Natural sediment collected includes: a) weathered marl soil; b) pale brown sediment from soil horizon B; c) terra-fusca soil; d) terra-rossa soil.

Both architectural materials and natural sediments have been preliminary analysed in the field on the basis of their colour and texture and divided in three groups: deposits characterised by red/brown silty/sandy clay loam; deposits characterised by pale-brown/yellow sandy clay loam and deposits characterised by white silty clay.

Micromorphology enhanced field observations, through high-resolution analysis of distinctive attributes and components of architectural materials analysed, and enabled a classification of distinctive deposit Types, as examined in Chapter 4. FTIR and XRF integrated micromorphological observations with analyses of mineralogical and chemical composition of both architectural materials and natural sediments.

Mineralogical analysis using FTIR spectroscopy revealed that the dominant bands in the IR spectra of earthen materials analysed, are those related to clay and calcite. Clay, which constitutes one of the major components of samples analysed, is characterised by IR spectra at the region of 3600-3400 cm-^{1} (OH stretching), at 1000-1038 cm^{-1} (Si-O stretching) and at 600-500 (Si-O-Al stretching). Clay absorbance peaks of samples analysed corresponds to those of montmorillonite, distinguished by the broad absorption band at 3600-3400 cm^{-1} (Fig. 5.2) Montmorillonite, which forms as a result of weathering of ferromagnesian minerals, calcium feldspar and volcanic materials, is diffused in the Kouris Valley region, as also attested by XRD analysis conducted on local ceramic samples by the Chemistry laboratory of the University of Torino, Italy (Davit *et al*. 2014). Other identified clay peaks are at 1000-1031 cm^{-1} region (Si-O), 915 cm^{-1} (Al-OH), at 530-517 (Al-O-Si and Si-O-Si minerals), and a doublet at 799-780 cm^{-1}, which corresponds to quartz.

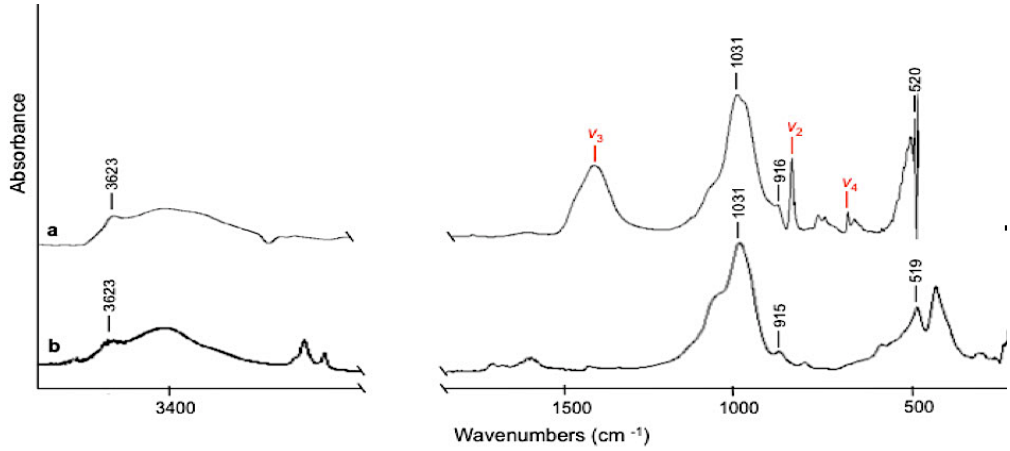


Figure 5.2 IR spectra of a) terra rossa sample with the characteristic peaks of montmorillonite clay, in black, and calcite peaks signed in red; compared to b) reference spectra of calcium montorillonite (Arizona) from Infrared Standards Library, Weizmann Institute of Science (Weiner 2010, 275-316; **http://www.weizmann.ac.il/kimmel-arch/infrared-spectra-library**).

Calcite is characterised by three infrared absorption peaks: ν_3, which corresponds to the asymmetric stretch (1420 cm^{-1}), and ν_2 and ν_4, which correspond to the out of plane-bending (875 cm^{-1}) and in-plane bending (712 cm^{-1}; Fig. 5.2). Calcite peaks were observed in the samples analysed due to the high calcite content both as primary mineral of the raw source used in the manufacture of these architectural materials, and as secondary product of post depositional alterations occurred in these materials.

On the basis of micromorphological and chemical composition, earthen architectural materials may be divided in three distinct clusters.

The first cluster comprises low calcareous red silty-sandy clay loam materials and includes red mud-bricks (deposit Type 2a) and earthen construction materials (deposit Type 3); these materials are characterised by low CaO concentration (10,12-12,99 w%) and high Al_2O_3 (13,25-15,97 w%) and SiO_2 (49,5-54,26) values. The second cluster comprises calcareous yellow sandy clay loam architectural materials including yellow mud-bricks (deposit Type 2b) and earthen wall plaster (deposit Type 4). These materials are characterised by high CaO value (24,84-30,41 w%) and relatively low values of Al_2O_3 (3,89 -6,06 w%) and SiO_2 (23,32-26,51 w%). The other distinctive element is Fe_2O_3; this element is significantly attested in red silty-sandy clay loam materials (8,85-10,55 w%) and is present in low concentration in yellow sandy clay loam materials (3,3-4,91 w%). The relationships between these main elements show different results if statistical analysed in bivariate plots. The values of Al_2O_3-SiO_2 and Fe_2O_3-Al_2O_3 show a liner relationship, while values of SiO_2- CaO and CaO- Fe_2O_3 show an inverse relationship (Fig.5.3). A difference in the trace element concentration was also observed between the two clusters, with lower values attested in calcareous yellow sandy clay loam

materials, possibly due to the diluting effect of carbonate/calcite content (Nodarou *et al*. 2008; Mommsen and Sjoberg 2007).

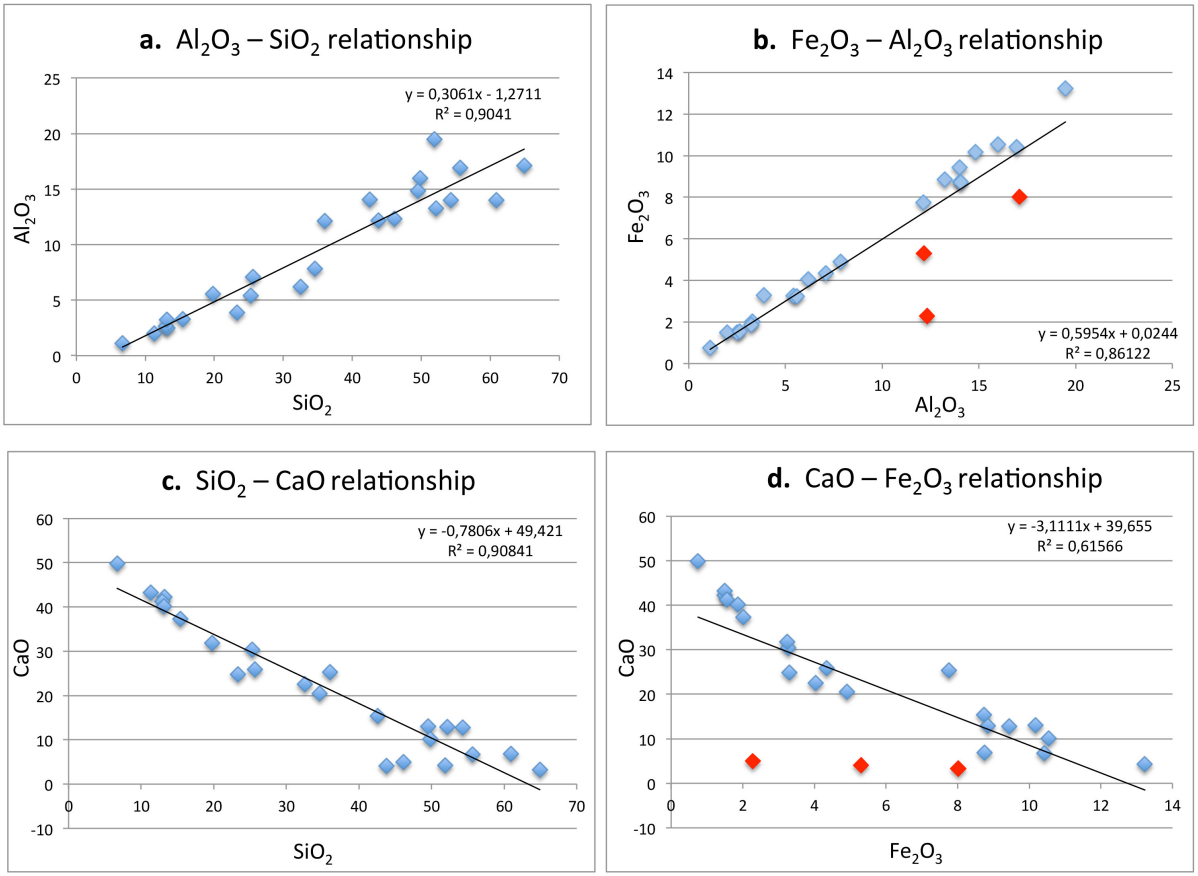


Figure 5.3 Scatter graphs showing the relationship between main elements in earthen materials, natural sediments and ceramic. a-b) Al_2O_3-SiO_2 and Fe_2O_3-Al_2O_3 show a liner regression; however, in the scatter plot b three outliers have been identified, pertaining to ceramic samples 26, 27, 28 (in red); c-d) SiO_2- CaO and CaO- Fe_2O_3 show an inverse relationship with outliers in scatter plot d, corresponding to ceramic samples 26, 27, 28 (in red).

White, high-calcareous silty clay laom mud-bricks, deposit Type 2c, represents a variation of the two clusters described. White silty clay loam mud-bricks are characterised by very high CaO/MnO values, 44,18 and 50,54 w% (the highest values recorded) and very low Al_2O_3, 1-2 w%, and SiO_2, 6-13 w% (the lowest recorded); the Fe_2O_3, value is almost absent if compared with other samples (< 1%) and the depletion of trace elements is evident in the low values recorded (see Appendix D).

The difference in element concentration, between low calcareous, calcareous and high calcareous clays, very much reflects the micromorphological distinction between the red silty/sandy clay loam that characterises mud-bricks deposit Types 2a and earthen construction material deposit Type 3, the yellow sandy clay loam that characterise yellow mud-bricks deposit Type 2b and earthen wall plaster deposit Type 4, and the white silty clay that characterises mudbricks deposit Type 2c. These compositional differences are illustrated in the

ternary diagram Al_2O_3-SiO_2-(MnO+CaO), Fig. 5.4, where earthen architectural materials are compared with local natural sediments and local ceramic productions.

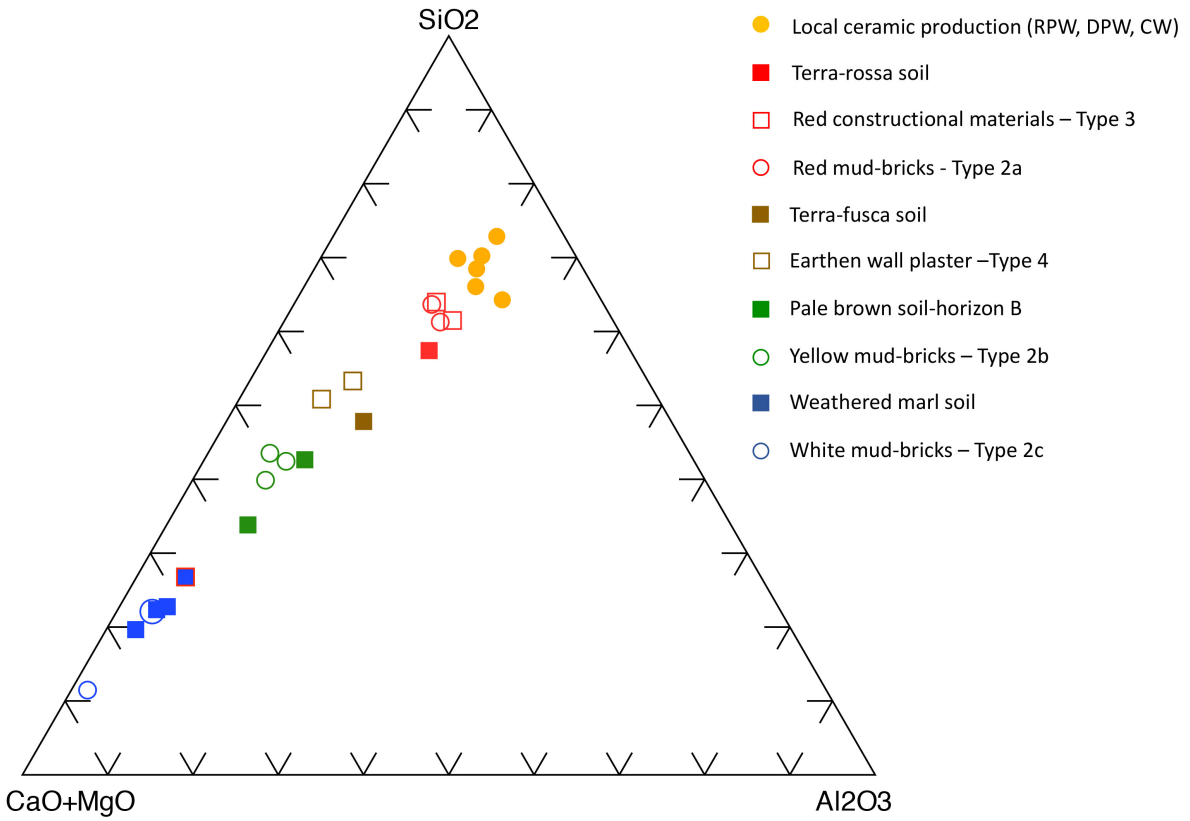


Figure 5.4 Ternary diagram showing the ratio between CaO+Mg/SiO2/Al2O3 in earthen materials, natural sediments and ceramic sherds analysed. The materials are clustered in four distinct groups depending on materials composition.

The identification of four distinct clusters, well defined in terms of standard variation, indicates the use of diverse raw materials in the production of earthen architectural materials and ceramic.

Low calcareous terra-rossa sediment (indicated in the diagram by a red filled square) was the preferential material used in red silty clay laom mud-bricks, deposit Type 2a (indicated by red circle), and red sandy clay loam construction materials, deposit Type 3 (indicated by red square). Calcareous terra-fusca (indicated by brown filled square), was selected for the manufacture of earthen wall plaster, deposit Type 4 (indicated by brown square); pale brown soil horizon B (indicated by green filled square), which is characterised by a composition similar to terra-fusca but richer in CaO, was used in the manufacture of yellow sandy clay loam mud-bricks, deposit Type 2b (indicated by green circles). High calcareous silty clay weathered marl sediment (indicated by blue filled squares) was used in white, silty clay mud-bricks, deposit Type 1c (indicated by blue circles). One of the white mudbrick analysed is characterised by a very high CaO content, which may be attributed to the possible addition of lime temper

acting as stabiliser and strengthening agent (see Section 5.3.1). All the architectural materials analysed are characterised by very high content of phyllosilicates minerals, which ensure plasticity to the raw sediment.

In the ternary diagram, architectural materials and local sediments are compared with chemical data of ceramics shards pertaining to Red Polished ware, Drab Polished ware and Course ware local productions (orange dots) in order to analyse possible similarities and differences in the selection and procurement of raw materials. Ceramic shards are characterised by Al_2O_3-SiO_2 concentration similar to that observed in red silty/sandy clay loam deposit Types. However, the Fe_2O_3 content is higher, with values between 8,02-13,23 w%, and the CaO content, is lower, between 3,28 and 6,87 w%. These compositional differences may indicate the use of a diverse source, possibly of alluvial origin, since alluvial sediments of Kouris valley are naturally rich in iron and poor in carbonate, as they formed from erosion and transportation of Troodos ophiolite deposits, according to geological studies conducted in this area (Harrison *et al*. 2008).

The lack of available alluvial sediments as consequence of the strong geomorphological transformations that affected the river valley area after the Kouris dam construction in 1988 (Boronina *et al*. 2003) limited the possibility to confirm the presumed use of alluvial sediment in local ceramic production. Future analysis will try to overcome this limitation, by collecting and analysing selected clay materials from ophiolithic deposits of Troodos area.

The compositional difference between earthen architectural materials and ceramic samples analysed may suggest remarkable considerations concerning the selection of different sources in relation to the accessibility of natural sediments and the function of the final product (Gosselain and Livingstone Smith 2005). Architectural materials, whose function is to guarantee stability and duration to the structure, were manufactured using an easy accessible resource, as terra-rossa, in order to possibly simplify the building operations and reduce the time of production (Wright 2005; Keefe 2005). The natural occurrence of carbonate rocks in terra-rossa makes this natural sediment more suitable for the manufacture of architectural materials, as the propriety of carbonate inclusions to improve the resistance to mechanical stress, preventing cracks and rapid degradation of earthen architectural materials (Hoard *et al*. 1995). On the contrary, an alluvial source, which possibly was selected from the Kouris river valley, was used for ceramic production, as igneous rocks and quartz sand, which are natural components of local alluvial sediments (Harrison *et al*. 2008), improve the structural properties of the ceramic body, by reducing shrinkage and increasing the resistance to thermal stress during firing process (Rice 1987, 94-96; Quinn 2010, 188-203).

5.2.2 Composition of lime-plaster types

Plaster samples and natural limestone samples were collected and preliminary analysed during the excavation campaigns 2013-2014.

Sixteen lime-plaster types, pertaining to different structures as walls, floors and architectural features as well as two lime-mortars have been selected for this study to obtain maximal diversity of deposits types. Three natural sediments pertaining to local marl, softer chalcky limestone, which is locally known as *havara*, and to secondary calcrete-like formation, which is known as *kafkalla* (Thomas 2005, 12-13; Xenophontos 1985), have been used as comparative materials to analyse possible differentiations in use of local calcite resources in plaster production.

Lime-plaster types have been preliminary analysed in the field and distinguished in four different clusters on the basis of their colour: white plasters, yellow/buff plasters, pink/pale brown plasters and grey plasters. Micromorphological analysis enhanced this preliminary characterisation by enabling the identification of specific characteristics of plasters analysed as mineral grains, microstructure and inclusions types (inorganic, organic and anthropogenic) and the consequent classification of these material in four distinct deposit Types and relative sub-groups, as examined in Chapter 4. FTIR and XRF analyses further improved the resulting data-set with mineralogical and compositional data of lime-plaster types and natural calcite samples.

Mineralogical analyses show that all the study-materials are characterised predominantly by calcite, as visible in the absorption peaks at 2517 and 1796 cm^{-1}, 1420-1410 cm^{-1} (ν_3), 875 cm^{-1} (ν_2), 715 cm^{-1} (ν_4); clay at 3620-3485 cm^{-1}, 1030 cm^{-1}, 520 cm^{-1} and quartz at 797-780 cm^{-1} (Fig 5.5).

The mineralogical differences identified both in natural sediments and lime-plaster types analysed are mainly related to the different proportion between clay and calcite. Among the natural calcite samples analysed, only soft chalky *havara,* (sample 22) shows moderate intensity in clay absorbance, with noticeable peaks at 3600-3400, 1030 and 500 cm^{-1} regions. Differently harder marl and *kafkalla* (samples 23 and 24) are characterised by very weak absorbance of clay (Fig. 5.6).

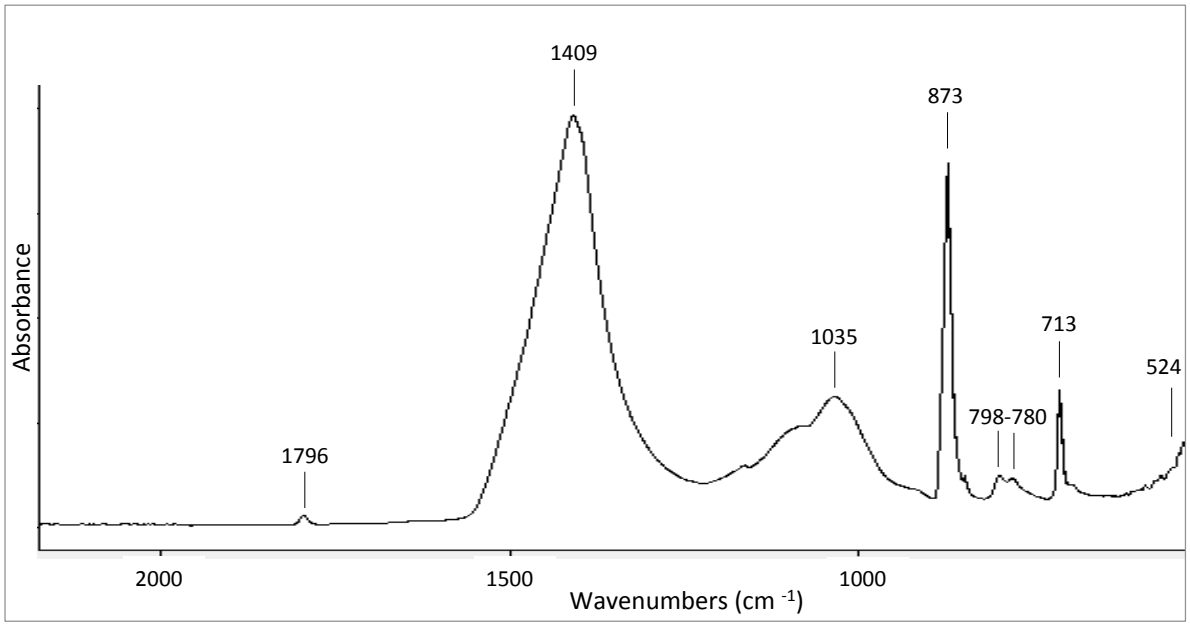


Figure 5.5 IR spectra of plaster floor KVP13.14, Type 6c, at the region 2000-500 cm^{-1}, showing peaks of calcite at 2517 and 1796 cm^{-1}, 1420-1410 cm^{-1} (ν_3), 875 cm^{-1} (ν_2), 715 cm^{-1} (ν_4); clay at 3620-3485 cm^{-1}, 1030 cm^{-1}, 520 cm^{-1} and quartz at 797-780 cm^{-1}.

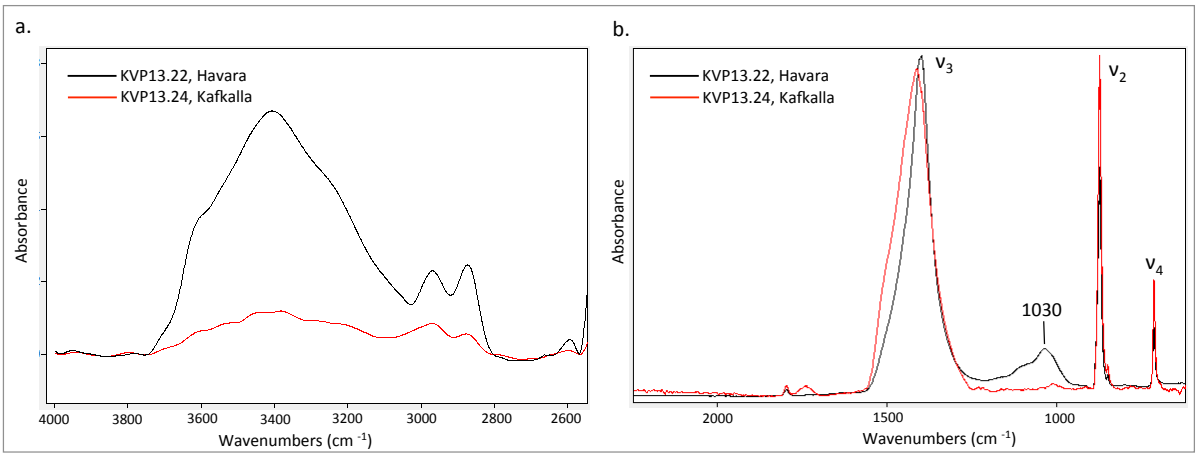


Figure 5.6 IR spectra of limestone samples: soft, chalky havara (in black) and harder kafkalla (in red); a) clay absorbance band at 3000cm-1 region showing higher clay absorbance of havara compared to kafkalla; b) clay peak at 1030cm-1 is moderate in havara limestone and almost absent in kafkalla; oppositely absorbance of calcite in peaks v2 and v4 is higher in kafkalla**.**

The IR spectra of plaster samples pointed out to similar distinctions. The first group of lime-plasters shows moderate clay absorbance peaks at 3600 and 1030 cm^{-1} regions, while the second group of plasters show very weak absorbance of clay. The idea that these differences in clay absorbance may reflect the use of diverse calcite sources is supported by micromorphological analysis. Micromorphological data indicate the presence of siliceous spicule (see 4.4.3), which are microfossils inherited from the chalk deposits of Pakhna formation (Robertson 1998), in *havara* sample and in plasters with higher clay absorbance, and the absence of spicule in plasters with weak clay absorbance, including marl and *kafkalla* samples (see Table 5.2). This observation, however, needs to be carefully evaluated through

future micro-IR and micro-chemical analysis on selected points on thin-sections of plaster materials in order to exclude that the presence of clay in plaster samples may depend on possible addition of clay-rich aggregates.

Table 5.2 Correlation between intensity of clay absorbance in IR spectra and occurrence of spicule in plaster samples analysed, which may be connected to the use of a specific carbonate source, possibly chalky havara.

Sample	Type	Intensity of clay absorbance	Spicule (%)
KVP13.5	Feature plaster, Type 8a	Moderate/strong	2
KVP13.6	Feature plaster, Type 8a	Moderate/strong	2
KVP13.7	Feature plaster, Type 8a	Moderate/strong	2
KVP13.9	Feature plaster, Type 8b	Moderate	2
KVP13.8	Wall lime-plaster, Type 5	Moderate	5
KVP13.10	Floor plaster, Type 9a	Moderate/strong	10
KVP13.21	Floor plaster, Type 9a	Moderate/strong	15-20
KVP13.12	Floor plaster, Type 9c	Moderate	2-5
KVP13.14	Floor plaster, Type 9c	Moderate	2-5
KVP13.15	Floor plaster, Type 9c	Moderate	2-5
KVP13.20	Mortar, Type 4a	Moderate	2
KVP13.11	Floor plaster, Type 6b	Moderate/weak	2
KVP13.13	Floor plaster, Type 6c	Weak	0
KVP14.2/697	Floor plaster, Type 6d	Weak	0
KVP13.19	Applied mortar, Type 4b	Weak	0

One outlier has been identified among the plasters analysed. Silty clay floor plaster KVP13.10 deposit Type 9a, shows stronger clay peaks in comparison with other plaster analysed, standard calcite bands, and a peak at 725 cm^{-1}, which pertains to dolomite (Fig 5.7). The presence of dolomite seems to be confirmed by XRF analysis, which indicates the presence of a higher amount of magnesium in this plaster floor, compared with other study-samples (3,24 w% of Mg compared to 0,7-1 w% of other samples; Fig. 5.8). The presence of dolomite, even if attested as secondary mineral, sheds light on the possible presence of dolomite-rich outcrops in the limestone formation of Kouris region and the accidental and/or deliberate use of this source in the plaster production at Erimi-LtP.

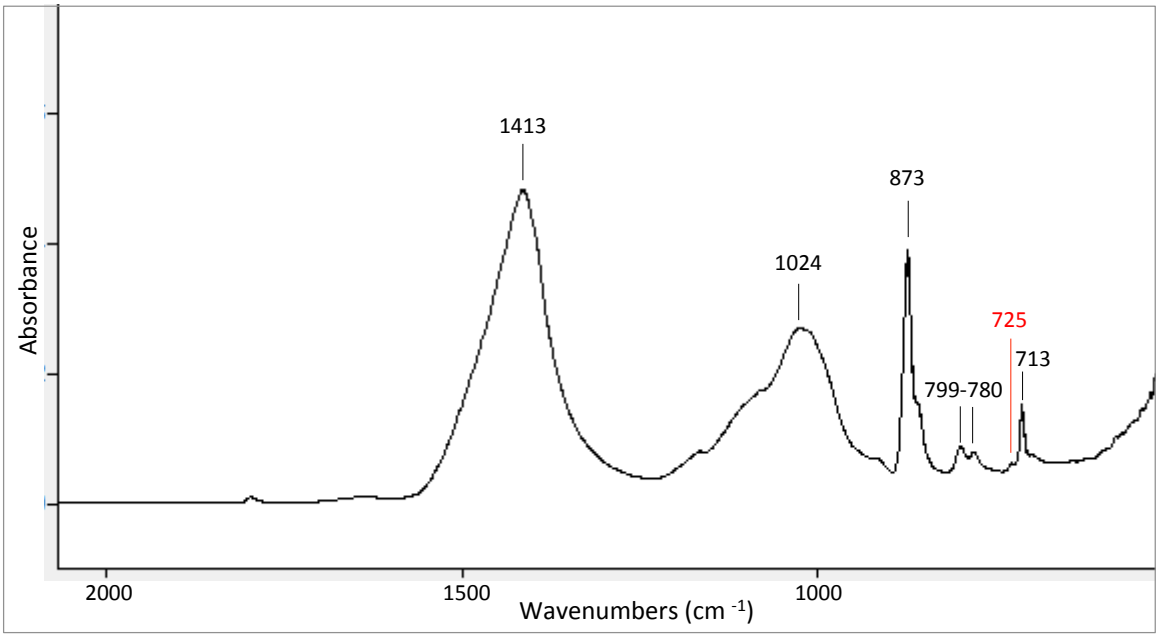


Figure 5.7 IR spectra of plaster floor KVP13.10, Type 9a, showing peaks of calcite, clay, quartz and a peak at 725 cm-^{1} corresponding to dolomite.

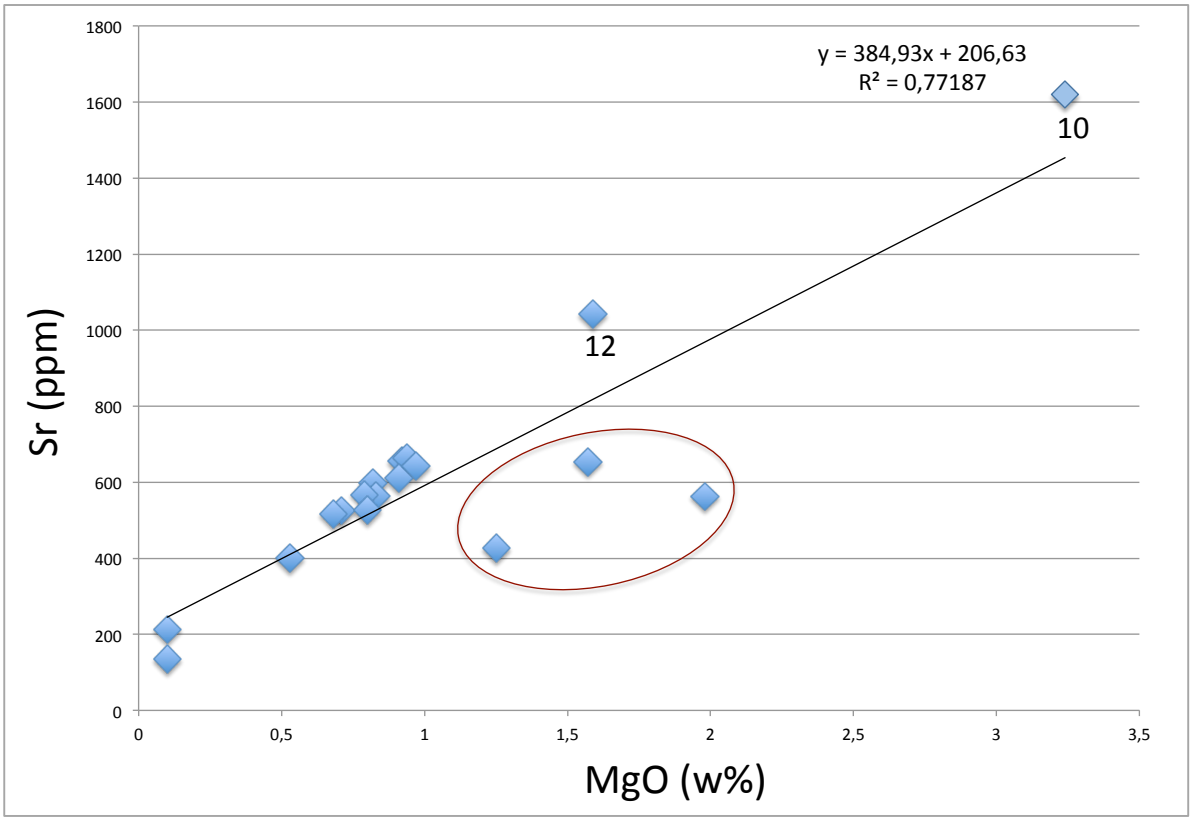


Figure 5.8 Scatter plot showing the ratio between elements of magnesium and strontium. Plaster floor KVP13.10 shows higher values of Mg and Sr, as also plaster floor KVP13.12, even if with minor percentages. All the other samples are clustered in the same section of the plot and are characterised by low values of Mg and Sr. Feature plasters KVP13.5,6,7, Type 8a (in the red-circle), show values of Mg around 1,5 w% due to the presence of 30% crushed ceramic mixed to the plaster.

XRF analysis detected the concentration of several major and trace elements in natural samples and lime-plaster samples analysed. The principal component identified both in natural sediments and plasters is CaO, with values between 53,71 and 32,16 w%. Magnesium, which is present as minor element, and strontium, attested as trace element, are associated with calcium (see Appendix D); these minerals often substitute calcium in calcite lattice (Anderson *et al*. 2014a, 328; Nichols 2009, 29)

Other significant elements are Al_2O_3 and SiO_2, which are related with the presence of clay and other minerals as quartz and feldspar, and are attested in the study-samples with different concentration. The lowest amount of Al_2O_3 and SiO_2 is recorded in hard marl and *kafkalla* limestone, sample 23 and 24 with values of 0,38-0,42 w% and 2,13-2,25 w% respectively. Soft *havara*, sample 22, instead shows higher concentration with 1,89 w% of aluminium and 5,25 w% of silicon (see Appendix D).

Plaster samples are characterised by similar elemental composition, although there are differences related to variation in ratio between CaO and Al_2O_3+SiO_2. The different concentration of aluminium and silicon in lime-plaster Types analysed may depend on the raw material used, *havara* versus marl and *kafkalla*, but also on the percentage of clay-rich aggregates added to the carbonate material during the manufacture to obtain different lime-plaster types.

Plaster samples analysed may be divided in three groups depending on the ratio between calcium carbonate and aluminium/silicon components, as showed in plot Fig.5.9. Feature plasters deposit Type 8a, are in the upper section of the plot; these are characterised by the highest amount of silicon and aluminium, but also iron, vanadium and chromium, due to the presence of 30% crushed ceramic added to the plaster as temper (see Section 5.3.1).

Lime-plasters samples that are characterised by 40 w% CaO and 8-15w% Al_2O_3+SiO_2 are in the middle and middle-lower area of the graph. This group includes the majority of lime-plaster Types; these materials were presumably produced using soft *havara*. Finally, in the lower section of the graph are marl and *kafakalla* samples (in red), and two plasters Types, which were possibly manufactured using *kafkalla*: sandy clay loam floor plaster KVP13.13 (deposit Type 9c) and sandy clay loam lime-mortar KVP13.19 (deposit Type 7b).

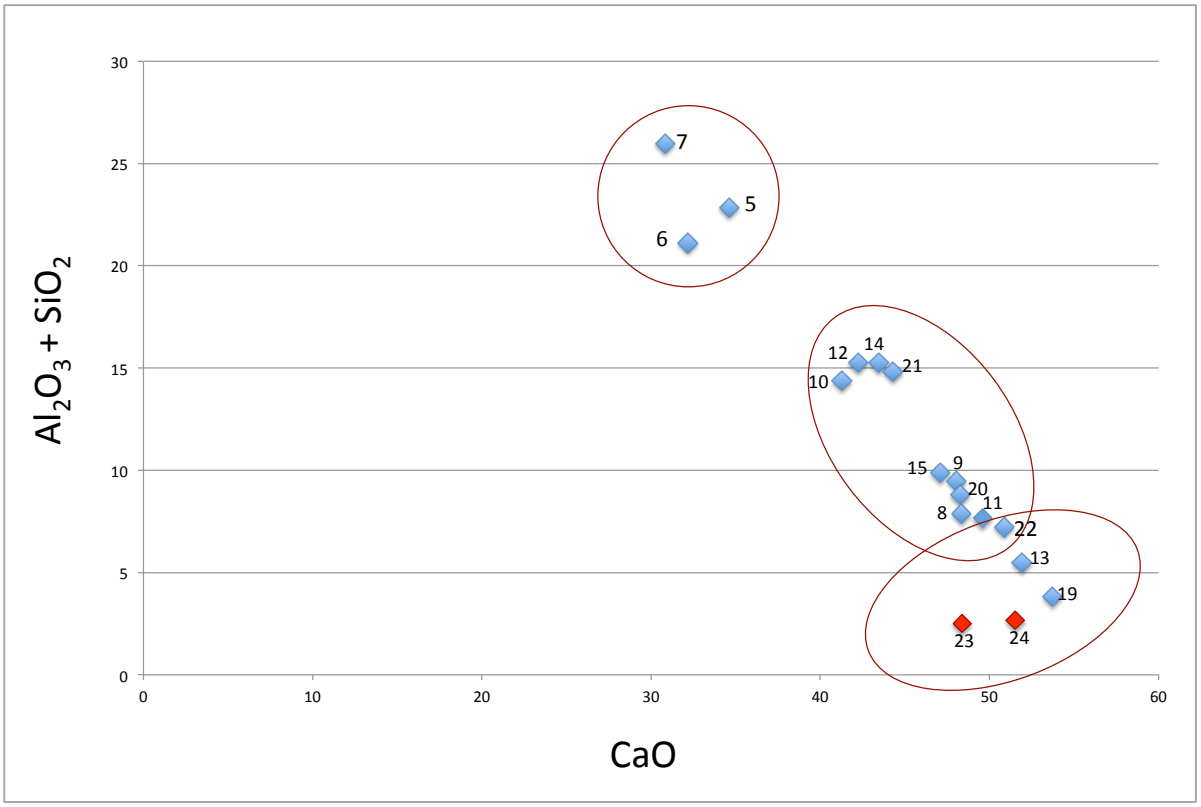


Figure 5.9 Scatter plot illustrating the ratio between CaO and Al_2O_3+SiO_2 concentration in plasters and natural sediments. The three groups identified are: feature plaster Type 8a in the upper section of the graph, characterised by higher concentration of aluminium and silicon (around 20 w%) due to the presence of clay-rich aggregates mixed with the plaster. The majority of plasters together with havara limestone sample 22 are in the middle section of the graph and are characterised by Al/Si values between 7 and 15 w%, and CaO values around 40 w%. Two sub-groups are identified: one with higher Al/Si content (15-20 w%), maybe due to clay-rich aggregates mixed with the plaster and another one with lower Al/Si content (7-10 w%). The third group, in the lower area of the plot, comprises natural marl and kafkalla samples and two plaster samples, with very low Al/Si values (3-5 w%) and high CaO concentration (45-50 w%).

5.2.3 Elemental characterisation of red-painting layers

Micromorphological analysis of earthen wall plaster samples KVP14.30 and KVP14.33, Type 4, revealed the occurrence 40-100µm thin layers of red clay/silty-clay. These thin layers were identified as layers of red paint, which were applied on the external face of the southern wall of building-unit SA I in Area A.

The sharp smooth boundary between the thin layer and the earthen wall plaster, identified by micromorphological analysis, excluded the possibility that these red, clay layers were produced by polishing/burnishing the external surface of the wall. This interpretation has been confirmed by comparing the surface of the two earthen wall plasters with the polished surfaces of two shards of Red Polished Ware. In contrast to the sharp and smooth boundary of the applied painting layers (5.10 a-d), the boundary between the polished slip and the ceramic body is diffuse irregular (Fig. 5.10 e,f; Quinn 2010).

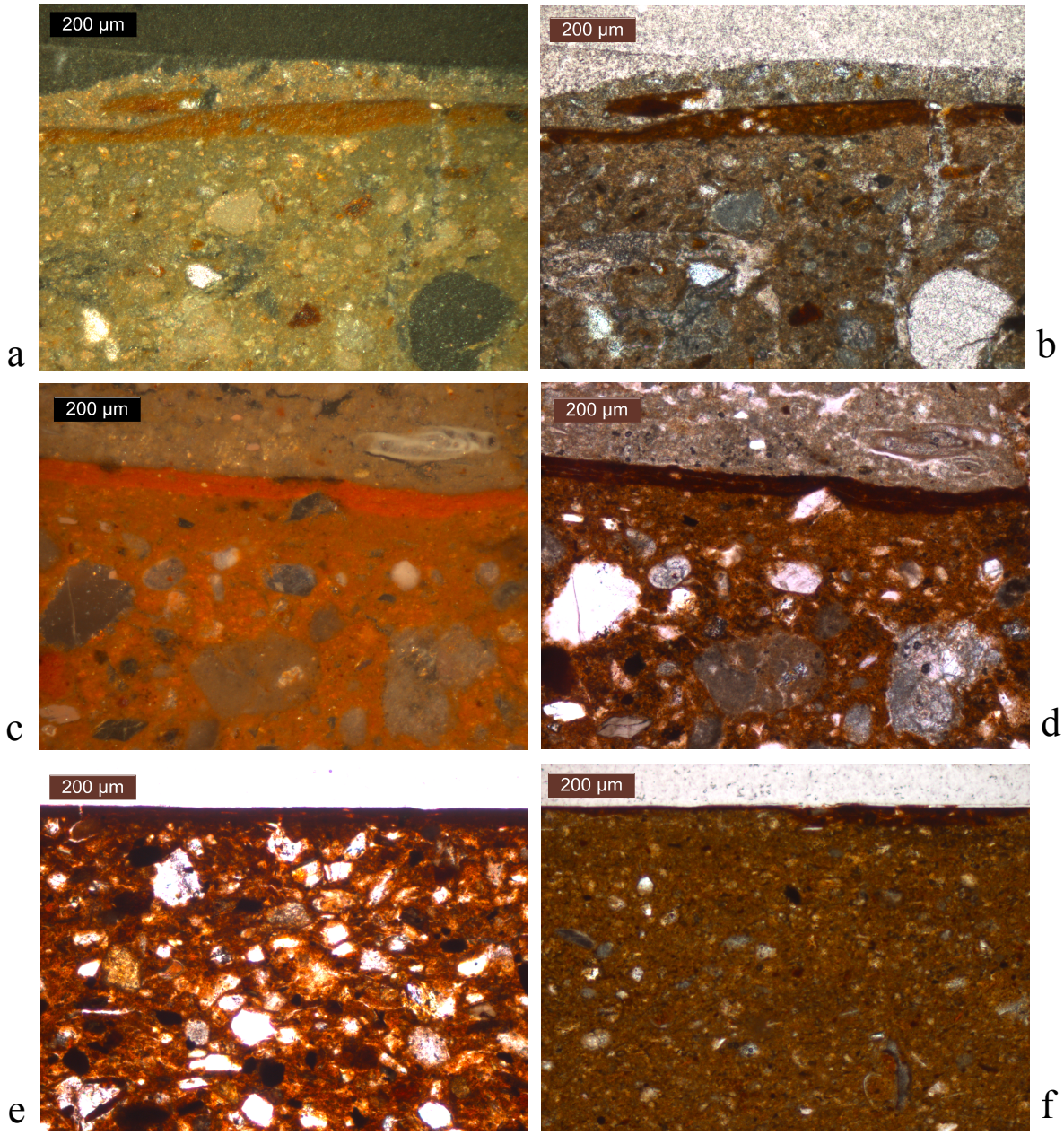


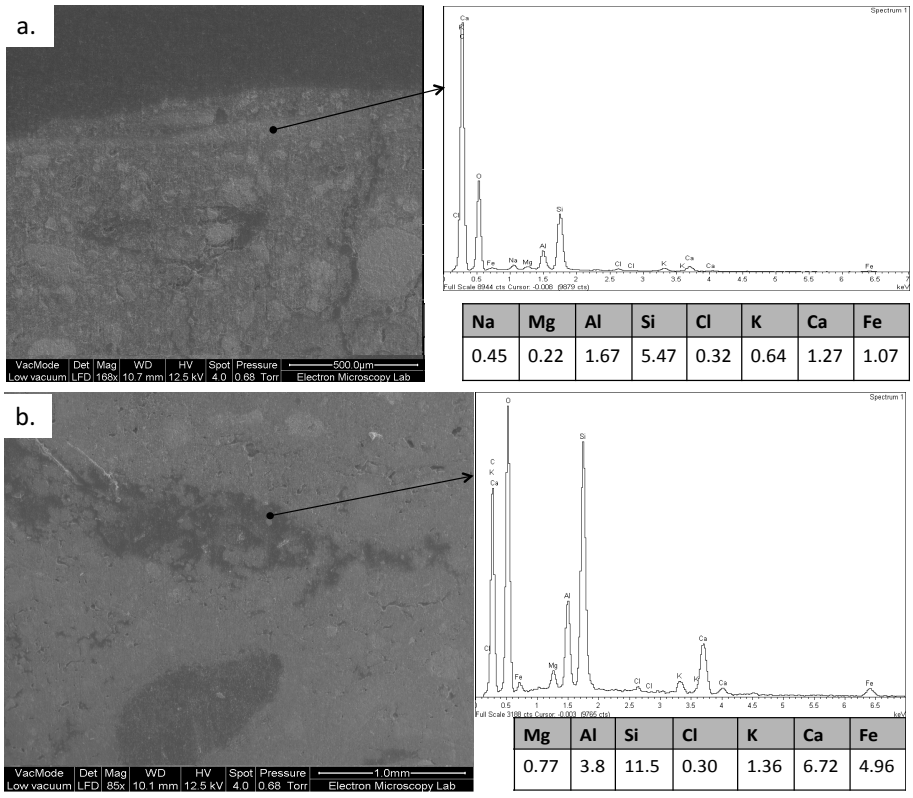
Figure 5.10 Photomicrographs of red paint applied on earthen wall plasters (a-d) compared to red polished layers of ceramic samples (e-f). a) Earthen wall plaster KVP14.30, Type 4, with red/orange layer of 40-50µm applied on the external surface of the sample. Note the sharp boundary between the paint layer and the sample, and the parallel oriented silty clay particles on the wall surface, as result of burnishing (also visible in Fig. c-d); under OIL; b) same sample in PPL. The grey silty-clay layer, on top of the red layer, is formed by post-depositional calcite. c) earthen wall plaster KVP14.33, Type 4, characterised by vivid red clay layer of 40-100µm, pertaining to painting/wash; in OIL; d) same sample in PPL; e) Red polished Ware with coarse-grained inclusions, KVP13.27. Note the diffuse boundary between the dark-red-polished layer (30-40µm) and the core of the pot, in PPL; f) Red Polished Ware with fine-grained inclusions and a very thin polished layer of 20-40µm on the external surface of the vessel; PPL.

Micro-chemical analysis, using SEM-EDX was applied to characterise these layers and to obtain data about the elemental composition of pigments used, and more specifically to distinguish between terra-rossa, red-ochre and umber, naturally occurring in Cyprus, within the sedimentary deposits containing iron-rich sediments (Costantinou and Govett 1972; Attard-Montalto 2010).

Elemental results show that the red paint layers contain moderated concentration of Iron, 1,07% in KVP14.30 and 4,96% in KVP14.33, elevated level of silicon, 5.47% and 11,55% respectively, and low level of magnesium (0.22%- 0,77%) and aluminium (1,67% -3,85%). The composition of the two red-layers is similar; however, lower values of Fe, Si, and Al have been detected in sample KVP14.30, possibly for the diluting effect of post-depositional calcite (Fig. 5.11; Mommsen and Sjoberg 2007)

The lack of manganese in both the two layers analysed excluded the possibility that raw umber was selected as natural pigments, since manganese together with iron is the principal component of umber (Costantinou and Govett 1972; Eastaugh *et al*. 2004). Possibly terra-rossa or red-ochre were preferred over umber for the preparation of these red paints.

Future and conclusive results will be accomplished by applying micro-IR and micro-Raman analyses, which will support this preliminary data-set with mineralogical and spectroscopic results (Quintana *et al*. 2015; Anderson *et al.* 2014a;). Furthermore, natural sediments of ochre and umber will be selected from the sulfidic deposit of Troodos, to be compared with results from archaeological materials in order to enhance the analysis of social, symbolic and ritual practices related to procurement, production and use of pigments in Cypriot Bronze age society (Erdogu *et al.* 2011; Jones 2004; Jones and MacGregor 2002; Young 2006).



Na	Mg	Al	Si	Cl	K	Ca	Fe
0.45	0.22	1.67	5.47	0.32	0.64	1.27	1.07

Mg	Al	Si	Cl	K	Ca	Fe
0.77	3.8	11.5	0.30	1.36	6.72	4.96

Figure 5.11 Scanning electron Microscope image of a) pigment KVP14.30 and b) KVP14.33 with EDX spectra and table reporting values in w% of principal chemical components.

5.3 Architectural material manufacture and techniques

5.3.1 Modification through tempers

As studies of ceramic and mud-bricks pointed out, similar source materials can be used to produce different products (Sillar and Tite 2000; Love 2013a). The final properties and the structural performance of architectural products depend not only on the raw materials selected but also on modifications through tempers. The selection of organic and inorganic additives and the subsequent modification of raw materials are important aspects of building practices and architectural materials technology, as by combining specific amount of different materials, builders can control the workability and final performance of architectural products (Quinn 2013, 156-170).

Micromorphological analysis of architectural material samples enabled the identification of a wide range of organic and inorganic aggregates, which were presumably added as temper to improve the natural characteristics of the source material selected and therefore, to manufacture different architectural products.

The use of organic and inorganic aggregates in red mud-bricks deposit Type 2a, and red construction material deposit Type 3, is confirmed by the occurrence of 2% plants voids, <5% silty size charred particles and 5% red, silty-clay sediment aggregates, which are poor in carbonate inclusions and presumably deriving from alluvial deposits of Kouris river. The occurrence of higher percentage of sand-size quartz in red construction materials (15% compared to >5% in red mud-bricks) may depend or on the different depth the natural sediment was sourced, resulting in different particle size and composition of the raw material (Hadjiparaskevas 2005; Quinn 2010, 151-171), or may be attributed to the deliberate addition of quartz sand to improve cohesion and mechanical strength of plastic terra rossa-soil, which is characterised by fairly high clay content (Thomas 2005, 25). Even though, this suggestion is supported by ethnographic and experimental studies of ceramic and bricks (Houben and Guillard 1989; Norton 1997; Keefe 2005; Thomas 2005) and by comparisons with pottery shards analysed, where similar percentage of quartz sand has been identified (Fig. 5.12), it cannot be verified with absolute certainty.

Sediment aggregates, similar to those used in red mud-bricks and red earthen construction materials, but not oxidised, were used as inorganic additives in the production of yellow mud-bricks deposit Type 2b and earthen wall plaster, deposit Type 4. The proportions observed however differ, with a higher percentage of sediment aggregates in yellow mud-bricks and earthen wall plasters (see Fig 5.13), possibly to compensate the low malleability of the poorly

plastic calcareous source. This idea may be also confirmed by the occurrence of 2% spherulites and 2% calcium oxalates, which although observed as minor inclusions, are significant indicators of the use of organic tempers, as dung and possibly chaff (Forget *et al*. 2015; Friesem *et al.* 2011; 2013; Shahack-Gross 2011; Nodarou *et al*. 2008; Matthews *et al.* 1997; Goldberg 1979*)*.

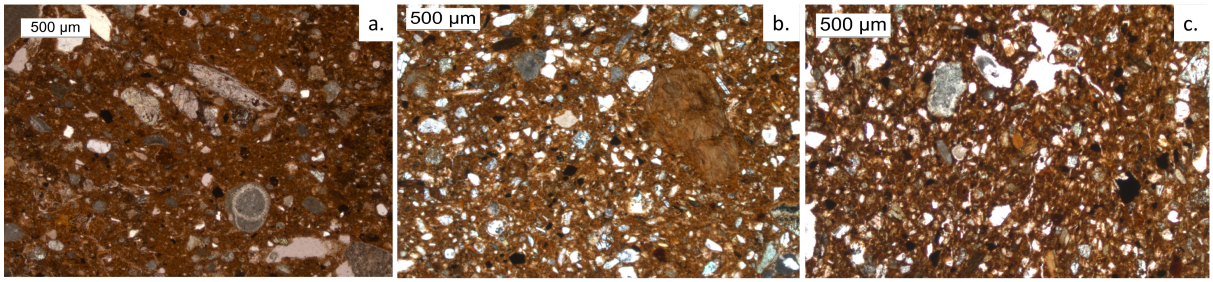


Figure 5.12 Photomicrographs of a) red silty clay loam mud-brick KVP13.2, deposit Type 2a, PPL; b) red sandy clay loam construction material, possibly from roofing structures; KVP14.32, deposit Type 3, PPL; c) sandy clay loam Drab Polished Ware (local production), KVP13.26, deposit Type 13a, PPL. Note the difference in occurrence of quartz sands in red mud-brick (a) and construction materials and ceramic (b-c).

The high calcareous raw material of white mud-bricks deposit Type 2c, was tempered with organic additives in slightly higher proportion than those observed in yellow calcareous mud-bricks deposit Type 2b and earthen wall plasters deposit Type 4. Finely chopped straw was probably mixed with the high calcareous clay, as suggested by the occurrence of 5% plant voids, identified in the microstructure of white-bricks. The common practice was to mix the high calcareous source with organic stabilisers in order to break down the soil and to allow total hydration and aeration of the mixture, resulting in the partial decay of the organic additive. In this way, the organic nutrients and elements were released into the mixture, bonding with the clay and providing the increased cohesion and water-proofing necessary to make a plastic and resistant product (Thomas 2005, 25-26). The addition of organic additives in calcareous and high calcareous clay products is further confirmed by XRF analysis, which revealed significant percentage of P_2O_5 compared to other architectural materials analysed; 0,34% in high calcareous materials compared to an average of 0,10% in other samples analysed (see Appendix D). Finely pulverised limestone dust was possibly added to the raw source of white mudbrick KVP13.16, as suggested by XRF analysis, which revealed a higher amount of CaO in this sample compared to the percentage attested in the raw material (see ternary diagram Fig. 5.4). Lime was used as stabiliser agent, and its use in bricks manufacture has also been record in prehistoric Levantine (Kingery *et al*. 1988, 226) and Cypriot communities (Le Brun *et al.* 1984, 31).

The identification of organic and inorganic additives in lime-plaster materials may be more challenging, especially when binders and aggregates are of the same nature, as the case of limestone sands temper, which was encountered in more than one lime plaster-types analysed. In sandy clay loam lime-mortars, deposit Type 7b, and in floor plaster, deposit Type 9c, the limestone sand, used as temper was identified on the basis of the sharp and angular shape of inclusions and the occurrence of unaltered bioclasts in limestone aggregates, which suggested that limestone was not altered by fire and was not subjected to calcination (Kingery *et al.* 1988; Gourdin and Kingery 1975; Goren and Goldberg 1991). Oven plaster, deposit Type 8b, are characterised by angular quartz grains of 200-300 μm, which, together with limestone sand aggregates, were possibly added to reinforce the structural properties of this plaster-type and obtain a fire-resistant material (Rice 1987, 94-96; Matthews 2005a, 372; Quinn 2010, 212-221).

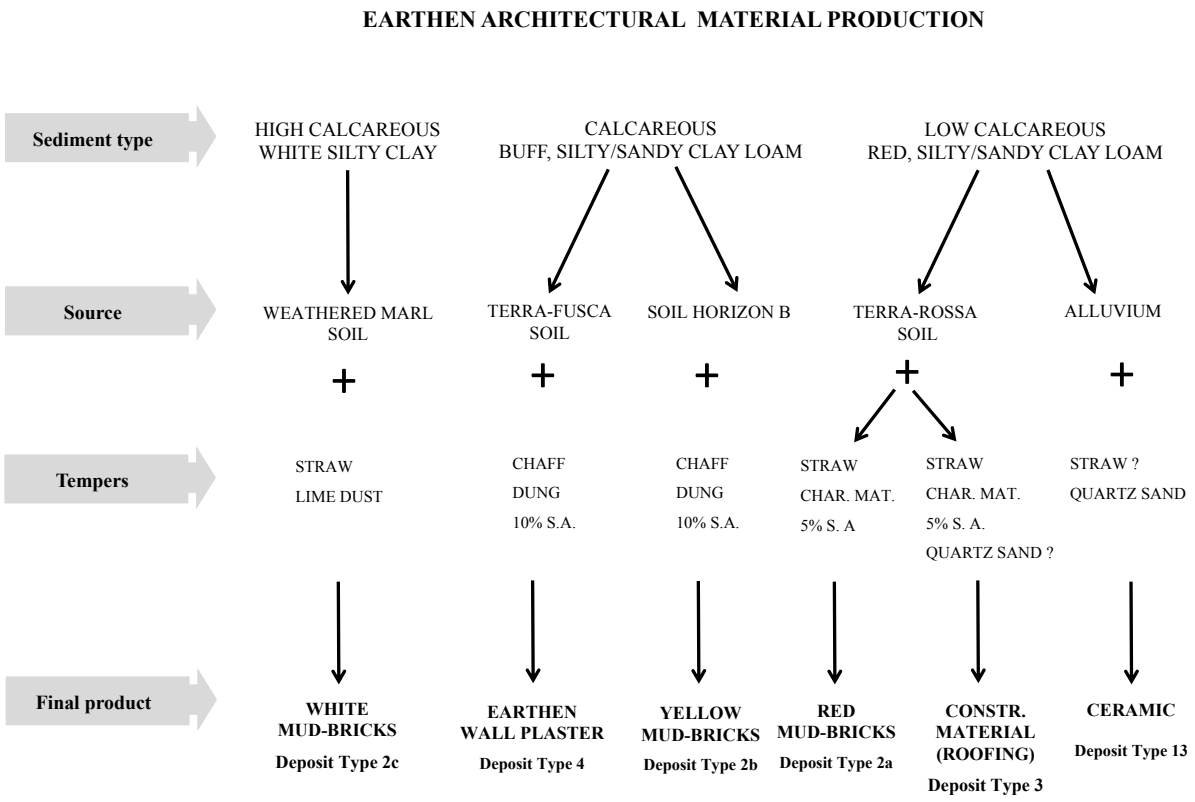


Figure 5.13 Graph showing sediment types and tempers used at Erimi-LtP for earthen architectural material and ceramic manufacture. S.A. = Sediment Aggregates.

Other inorganic tempers identified by micromorphological analysis of lime-plaster types include sharp and angular ceramic inclusions, which were added to lime-plaster applied as coating in circular mortar installations, deposit Type 8a, in order to improve the mechanical strength and/or to confer hydraulic properties to the materials, as proposed by analyses on

similar plaster in Cyprus (Philokyprou 2012a; 2012b; Turco *et al*. 2016) and near East contexts (Regev at al. 2010a; Moropoulou *et al.* 2000). Silty clay loam sediment aggregates were also used as inorganic tempers in silty clay loam floor plaster, deposit Type 9b.

Among the organic additives, dung was commonly mixed with lime-plaster at Erimi-LtP, as analysed in white silty clay floor plaster, deposit Type 9a, where >5% spherulites have been identified. The use of animal dung as plasticiser and binder in calcareous non-plastic materials is attested in ethnographic literature (Ashurst and Ashurst 1988) and confirmed by experimental analysis (Thomas 2005).

5.3.2 Manufacture practices

The study of manufacture practices of architectural materials offers good evidence to the analysis of production and social organization of labour and resources in ancient communities (Love 2013). For example, the analysis of shape and size of mudbricks may support the study of standardisation in bricks manufacture that may imply similarities in production, collective efforts, community involvement and possible specialisation of mudbrick-makers as more widely discussed in Chapter 8. Similarly, the analysis of earthen and lime plasters surfaces may reveal the occurrence of common and repeated building practices and support the analysis of diffusions and adoption of building techniques at Erimi-LtP and in bronze age Cypriot communities.

The analysis of shape and size of mud-bricks recovered at Erimi-LtP enabled the identification of two possible technologies adopted in bricks manufacture. The irregular shape and small size recorded in red and yellow mud-bricks deposit Type 2a and 2b (see Table 5.2), suggest that they were hand-shaped. (Philokyprou 1998, 173-185; Nodarou *et al*. 2008). On the contrary, the regular shape and massive size recorded in white mud-bricks deposit Type 2c, indicate that wooden moulds were possibly used.

Table 5.3 Size of mud-brick samples analysed at Erimi-LtP.

Sample	Description	Approx. size (length/width/thickness)
KVP13.2	Red silty clay loam mud-brick, deposit Type 2a	~24 x ~15 x 5 cm
KVP13.3	Red silty clay loam mud-brick, deposit Type 2a	~20 x ~13 x ~6 cm
KVP13.1	Yellow sandy clay loam mud-brick, deposit Type 2b.	Incomplete
KVP13.4	Yellow sandy clay loam mud-brick, deposit Type 2b.	Incomplete
KVP13.172	Yellow sandy clay loam mud-brick, deposit Type 2b.	Incomplete
KVP13.16	White silty clay mud-brick, deposit Type 2c	~35 x ~20 x 12 cm
KVP13.18	White silty clay mud-brick, deposit Type 2c	Incomplete

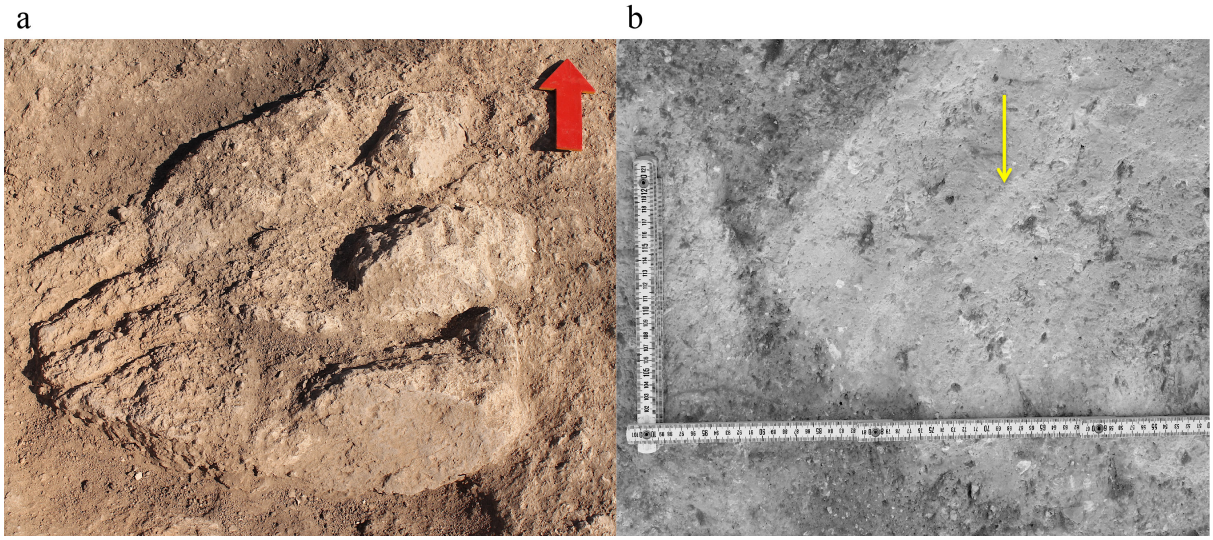


Figure 5.14 Mud-bricks from collapsed wall structures. a) Collapsed wall of room SA III, Area A with smaller size red mud-brick on the left and bigger, white bricks on the right. b) Focused image of yellow mud-bricks, in a collapsed wall in room SA IIa, Area A. The yellow arrow indicated the whiter mortar, which bind the mud-brick structure.

The insufficient number of integral mud-bricks recovered *in situ* at Erimi-LtP does not permit to confirm the occurrence of a possible standardisation in bricks production, that might be attributed to a specialisation of mudbrick makers, nor to study possible variation in shape and size of bricks between the early occupation Phase B and the later Phase A, which may support the analysis of development in mudbrick manufacture. However, archaeological and ethnographic analysis on mudbricks technologies from prehistoric and contemporary vernacular villages of Cyprus refer that both hand-shaped and mould-shaped mudbricks are attested in Cyprus since the Neolithic period (Philokyprou 2008; Ionas 1988; Olukoya Obafemi 2016). The co-hesitance of the two technologies in prehistoric settlements and contemporary villages of Cyprus, suggests that the development of mudbrick technology is not necessarily uni-linear but it is rather depending on socio-cultural and practical choices operated by mud-brick makers, as discussed Section 5.5.3 and more widely examined in Chapter 8.

Field analysis of earthen and lime plaster walls recovered at Erimi-LtP enabled the identification of repeated building practices that were diffused in different Cypriot regions, among prehistoric and protohistoric communities. Earthen wall plasters were applied on the external face of wall structures, in 2-3 cm thick layers. The surface was usually burnished with the use of pebbles of by wooden sticks in order to even out the layer and to rise the finer clay particles on the surface, which would then become parallel oriented on the surface, as analysed in thin-sections KVP14.30 and KVP14.33, deposit Type 4 (Fig.5.10 a-d). This technique also served to push the clay into the many micro cracks in the wall in order to improve cohesion between the applied plaster and the wall surface (Thomas 2005, 26). The application of this

external wall plaster would have provided a well-structured barrier against erosion by natural agents. This protective material functioned also as vehicle for colour and figural decoration, and as convenient space for social representation as attested by the occurrence of red-painting layers on the two earthen wall plaster samples analysed in building-unit SA I, KVP14.30 and KVP14.33, deposit Type 4 (see also 5.2.3; Wright 1992, 423-424; Matthews 2005a; Anderson *et al*. 2014).

Lime wall plasters were applied on the internal face of mudbrick wall structures in 2 cm thick layers, as analysed in building-unit SA III, in Area A. The practice was to plaster the interior wall and the floor of the building at the same time, using the same material. Rounded pebbles were set in the lower part of the wall, between the vertical surface and the floor, in order to make the application of plaster layer easier, but also to possibly increase water tightness within the building and/or to avoid rodent activities inside the building (Philokyprou 2008; 2011; Matthews *et al.* 1997). This practice has been recorded in several Chalcolithic, Bronze age and Late Bronze Age Cypriot sites as Kissonerga-*Mosphilia*, Alambra-*Mouttes*, Kalavassos-*Ayios Dhimitrios* and Alassa-*Paleotaverna* (Philokyrprou 2011; 1998, 234-247), suggesting that similar techniques were wide-spread in different Cypriot regions and that functional building practices, developed by prehistoric household communities were transmitted and re-adopted by protohistoric communities.



Figure 5.15 Pebbles (on the bottom left of the image), set at the conjunction between the floor and the vertical surface of the wall, in order to ease the application of plaster in building-unit SA III, Area A.

5.3.3 Pyrotechnological development in lime-plaster industry

Fired lime-plaster is the results of chemical reaction of heated calcite which is fired at high temperatures, generally 800-900° C and slaked with water in order to produce a material that, once dried under atmospheric condition, re-establishes the same morphological, chemical and mineralogical composition of the parent material, as illustrated in Figure5.16 (Thomas 2010, 117-118; Leslie and Hughes 2002; Philokyprou 2011).

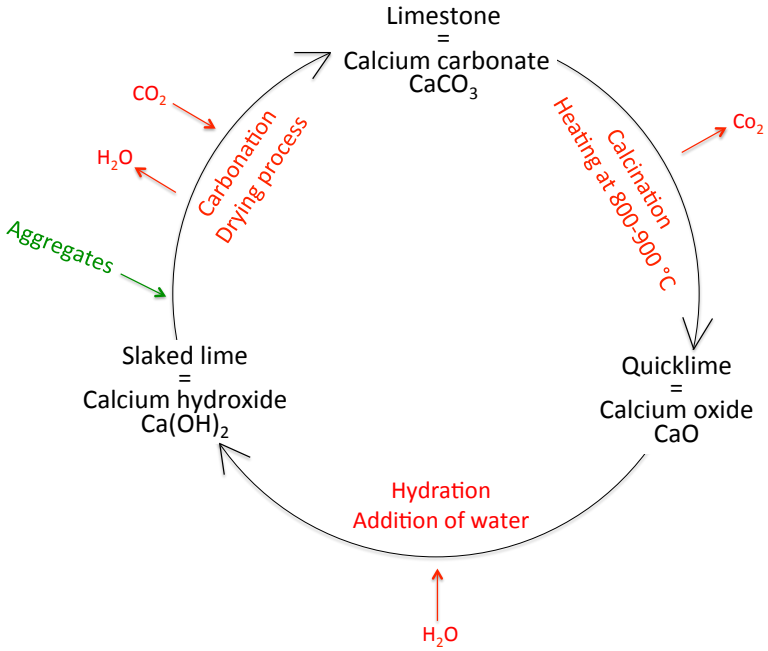


Figure 5.16 Lime cycle showing the processes of calcination, hydration and carbonation and the relative chemical reactions, which occur during these three processes (readapted after Thomas 2010; Leslie and Hughes 2002).

For this reason, the identification of fired and non-fired lime plaster is always problematic, and a methodological approach, which takes in account microscopic observations and chemical and spectroscopic analyses, is essential to accomplish an accurate study of pyrotechnological developments and use of plasters in ancient communities.

A range of methodological approaches have been developed to enhance the analysis of plaster in archaeological contexts, aimed at differentiating between fired and unfired plaster products, as illustrated in Table 5.4 (Kingery *et al*. 1988; Goren and Goldberg 1991; Karkanas 2007; Chu et.al 2008; Regev *et al.* 2010; Xu *et al.* 2015).

Field analysis at Erimi-LtP suggested that fired-lime plasters are generally harder, more indurate and less soluble than unfired lime plasters. At Erimi-LtP unfired plasters were applied in thin layers over a construction packing as observed in building-unit SA IIa and SA VI during the later phase A, or were also laid in very thick layers of c.8 cm during the early Phase B as analysed in building-unit SA VI (see Chapter 6).

Table 5.4 Methodological approaches used to analyse calcite formed by different mechanisms.

Technique	Strength	Limitation	References
SEM-EDX	Identification of morphological and chemical composition May support the distinction between lime and gypsum plaster	Does not identify crystalline mineral components Does not support the identification between fired and unfired plaster.	Kingery *et al*.1988; Gourding & Kingery 1975
Micromorphology	Identification of microstructure, inclusions, nature of aggregates and mineralogy.	Not clear distinction between fired and unfired lime.	Goren & Goldberg 1991; Matthews *et al*. 1996; Karkanas 2007.
FTIR	Identification of mineralogical composition Support the distinction between geogenic, biogenic and anthropogenic calcite using the analysis of ratio between main calcite peaks heights.	Results depend on grinding setting	Chu *et al*. 2008
FTIR-grinding curve	Identification of mineralogical composition More reliable distinction between geogenic, biogenic and anthropogenic calcite, as calcite peaks height analysis in not affected by grinding.	Results may be altered by post depositional calcite.	Regev *et al.* 2010
FTIR grinding curve + Angle dependant XRD peaks width	More informative than previous methods since integrate FTIR with XRD	Less reliable results in calcite-rich environments as caves	- Xu *et al.* 2015

Micromorphological analysis of thin sections supplemented observations of hand specimens and revealed that fired-lime plasters are characterised by round micro-pores from evaporation of water content during setting, calcitic micro-aggregates, no added vegetal tempers and no bioclasts (see Fig. 7.7 c; Matthews 2005; Matthews *et al.* 2013). However, these characteristics are not always easily detectible since is rare to find pure fired-lime plasters as the frequent practice to mix fired-lime with marly clays and calcareous aggregates (Thomas 2005, 27-28).

FTIR spectroscopy has been further applied on lime-plaster types and natural calcite samples to distinguish geogenic calcite, as in limestone and in unfired-lime plasters, from pyrogenic calcite, as in fired-lime plasters (Regev *et al*. 2010a; Chu *et al.* 2007) in order to study pyrotechnological processes involved in the production of plasters at Erimi-LtP (Turco *et al*. 2016). This application is based on the assumption that calcite has distinctive structural disorder

signatures, which are generally higher in anthropogenic/pyrogenic calcite than in geogenic calcite (Xu *et al.* 2015; Regev *et al.* 2010a, 2010b; Chu *et al.* 2007).

Lime plaster-types and natural sediments have been analysed conforming to the methodology developed by Chu *et al.* (2007) and Regev *et al.* (2010a). According to their studies the ratio between the heights of ν_2 and ν_4 bands reflects the order of calcite crystal structure, therefore, a high ratio is indicative of disorder in crystal and implies that calcite was formed at high temperatures (Chu *et al.* 2007, 905).

Spectroscopic analyses were conducted on plasters samples to test the method on calcite-rich materials from Erimi-LtP and to improve the data-set produced by preliminary analysis applied to plaster samples collected during 2009-2012 fieldwork seasons by the Chemistry laboratory of the University of Torino (Turco *et al.* 2016).

The evaluation of ν_2/ν_4 ratio was calculated taking into account specific grinding settings, with full width at half maximum (FWHM) values included between 110-130 cm^{-1} (Fig. 5.17; Chu et. al. 2007). Results show that natural samples KVP13.22, 23 and 24 have a ratio of 3, while lime plaster samples fluctuate between 3.2 and 4.4. The highest values were recorded in feature plasters deposit Type 8a (KVP13.5, 6, 7) and in floor plaster KVP13.12 deposit Type 9b, with ratio of 4.3, 4, 4.4 and 4.1 respectively; the high calcite disorder identified in these samples may suggest that these lime plaster Types were produced with fired lime and, therefore, are pyrotechnological product. The lowest value was recorded in floor plaster KVP14.2/697 deposit Type 9d, which shows a ratio of 3, similar to that observed in geologic samples. According to this evidence, plaster floor 697 was produced with unfired lime, as also confirmed by micromorphological results, which indicate that this plaster was presumably made mixing crushed limestone with water (see Section 4.4.9). Values in other plaster samples are included between 3.2 and 3.8; these data, differently from the previous ones, do not provide any definitive result about alterations of calcite and manufacture of these plasters (see Table 5.5).

Current data indicate that values recorded in lime-plaster samples analysed need to be evaluated carefully. It is extremely important to consider that all the samples from Erimi-LtP are altered by post-depositional calcite formation, which may interfere with the analysis of calcite IR spectra. That is the reason why the use of ν_2/ν_4 ratio analysis, although offers good potentials in the analysis of calcite formed by different mechanism and the study of pyrotechnology at Erimi-LtP, needs to be assessed by taking into account other possible analyses to supplement final results.

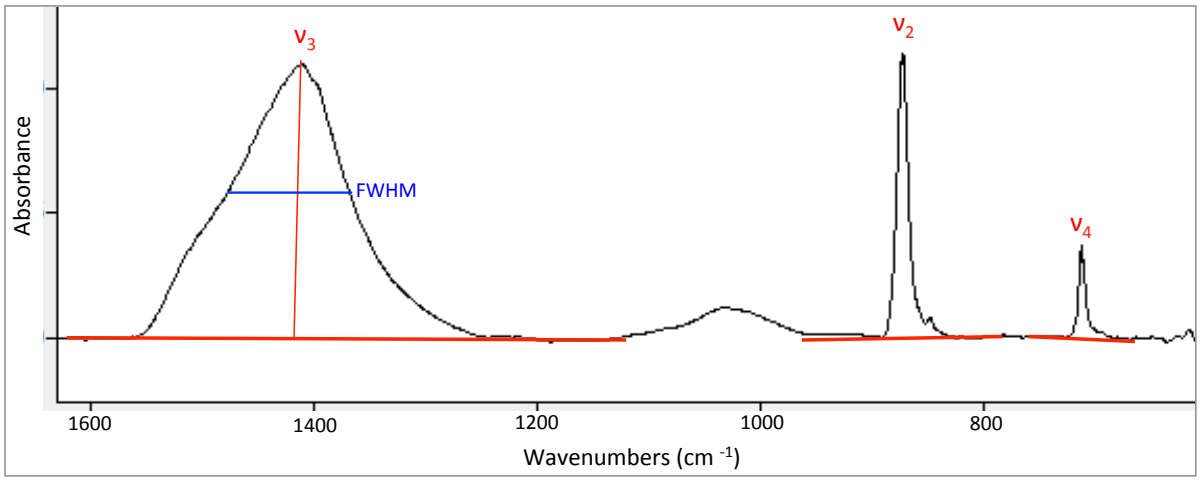


Figure 5.17 IR spectra of kafkalla sample KVP13.24, with indications of baselines (in red), used to calculate the height of ν2 and ν4 peaks. The baselines were drawn between the closest minima on either side of the measured peak (Chu *et al*. 2007; Regev *et al*. 2010). Spectra also show the 'full width at half maximum' FWHM, used to measure the grinding settings and check that samples were grounded according to settings recommended by Chu *et al* 2007. If the sample is grounded too vigorously, V3 peak gets narrower, and the ratio between ν2/ν4 increase (Chu *et al.* 2007).

Table 5.5 Values of ν_2/ν_4 ratio recorded in natural sediments and plaster samples, with related measurements of full width at half maximum, which indicate that samples have been grounded according to standard settings recommended by Chu *et al.* 2007.

Sample	Type	FWHM	ν_2/ν_4 ratio	Sample	Type	FWHM	ν_2/ν_4 ratio
KVP13.22	Havara	114	3	KVP13.11	Floor plas., Type 9b	118	3.8
KVP14.699	Havara	115	3	KVP13.12	Floor plas., Type 9c	127	4.1
KVP13.23	Marl	130	3	KVP13.13	Floor plas., Type 9c	121	3.4
KVP13.24	Kafkalla	129	3	KVP13.14	Floor plas., Type 9c	130	3.2
KVP13.5	Ft. plaster Type 8a	126	4.3	KVP13.15	Floor plas., Type 9c	121	3.4
KVP13.6	Ft. plaster Type 8a	121	4	KVP13.19	Mortar, Type 7b	115	3.7
KVP13.7	Ft. plaster Type 8a	123	4.4	KVP13.20	Mortar , Type 7a	112	3.6
KVP13.8	Wall plaster, Type 5	124	3.8	KVP13.21	Floor plas., Type 9a	112	3.8
KVP13.9	Ft. plaster Type 8b	115	3.5	KVP14.697	Floor plas., Type 9d	110	3
KVP13.10	Floor plas., Type 9a	124	3.6				

Further analysis will involve the production of experimental plasters as reference materials to evaluate the alterations of calcite exposed to elevated temperatures (Chu *et al*. 2007; Regev *et al.* 2010a; 2010b). In addition, FTIR grinding curves will be used in conjunction with analysis of angle-dependant XRD peaks width, conforming to the new method developed by Xu et.al (2015). These applications will permit to obtain more robust data about structural differences between geogenic and pyrogenic calcite and will possibly enhance the analysis of development of pyrotechnology in prehistoric Cypriot communities.

5.3.4 Carving and dressing stone: the analysis of tooling marks

The analysis of building practices related with carving the bedrock floor and dressing limestone blocks is particularly relevant at Erimi-LtP considering that the entire settlement was constructed by carving the limestone foundation bedrock in order to create an organised system of building-units, semi-open and open spaces, as examined in Chapter 6 and 7.

This study has been included in the thesis research in order to integrate the results obtained from multi-proxy analysis of architectural materials and to collected further evidence to analyse the organisation of building practices and the involvement of individual and communal effort in demanding and challenging activities as carving and construction of stone structures.

The practice of carving the bedrock floor was conducted using a pick and a lever in combination with wetted wedges and a hammer, according to archaeological and ethnographic evidence presented by Wright (1985; 1992) in his studies about ancient building techniques in Levant and Cyprus. Presumably limestone blocks were carved with a specific size or module in order to regularise the carving process and to exploit the carved stone as much as possible in buildings construction. The carving module may be analysed by identifying the biggest blocks used in the built area; at Erimi-LtP this module or sub-module may possibly be identified in the monolithic limestone block of 1.85x0.65m, which was dressed and used as threshold in building-unit SA I, in Area A.

The study of carving and dressing methods and techniques used at Erimi-LtP has been conducted by the analysis of tooling marks, which were identified on the foundation limestone bedrock. Two types of tools were used in carving and dressing activities: the striking percussion tools such as hammer, pick and axe, and the struck percussion tools as chisel, punch and point. The tooling marks identified at the site have been divided in three different categories on the basis of tools and technique used, which reflects specific building practice.

Group 1 comprises the signs left by a tool as a punch or a point which was used to scrabble the surface of the bedrock and to roughly dress the limestone foundation bases of building-units (Fig. 5.18 a). Group 2 comprises broken forrows left by a pointed tool, which was used to shape bedrock surfaces and corners of building-units (Fig. 5.18 b). Group 3 comprises tooling marks left by chisels; they have been divided in two sub-groups. Group 3a includes parallel vertical line marks, which are resulting from the hard striking of a chisel with small tip. These signs are attested in vertical walls of carved basins (Fig. 5.18 c). Group 3b comprises very close hatching, which were obtained through the use of a chisel with a wide tip. This tool was used

to smoothing the limestone surfaces of channels, possibly to facilitate the flow of liquids (Fig. 5.18 d).

The evidence analysed suggest that a wide range of tools was used to carving and dressing limestone; however, these activities did not demand sophisticated tools or advanced technologies. What was required for quarrying and stone dressing was specialised labour and the competence to organise these activities, as discussed in Chapter 8 (Wright 1992, 362).

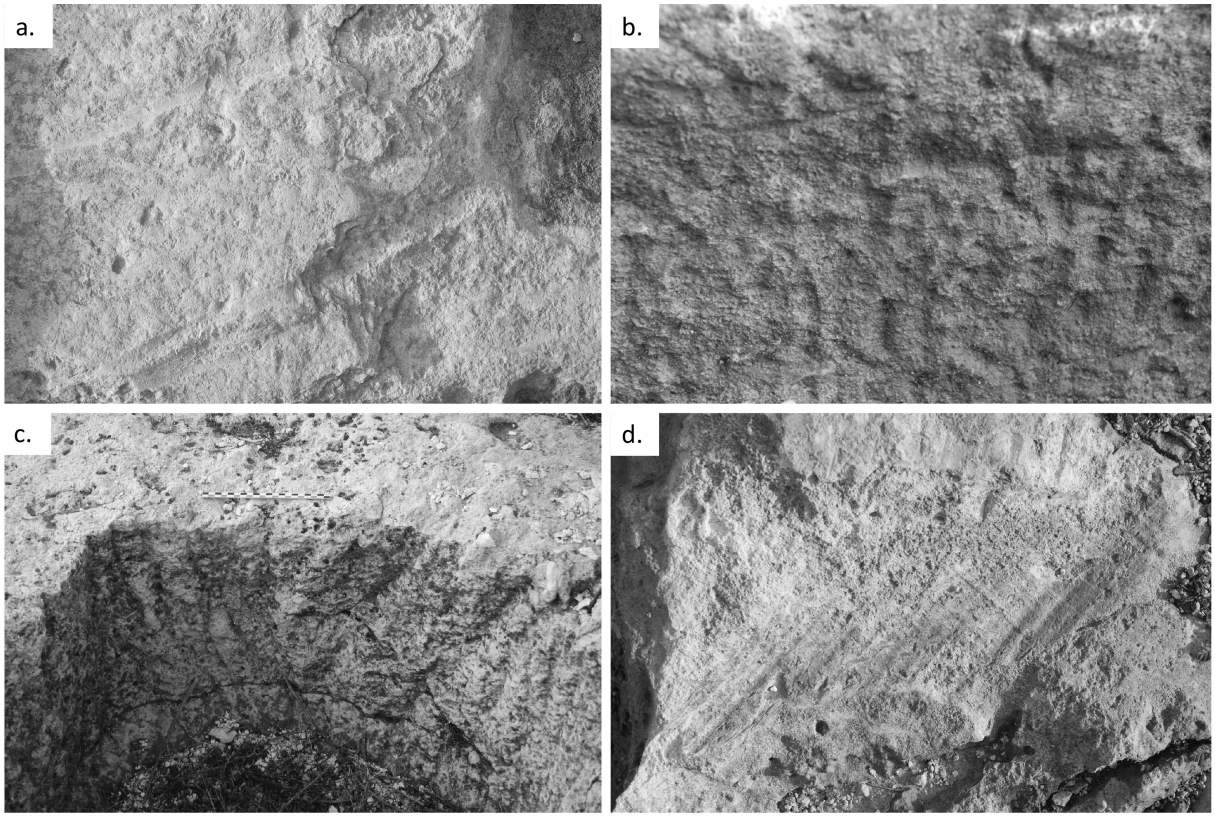


Figure 5.18 Tooling marks identified on the bedrock floor at Erimi-LtP: a) marks left by a punch or point; b) broken forrows left by a pointed tool; c) vertical line marks left by a chisel with a small tip; d) close hatching left by a chisel with a wide tip (Amadio and Chelazzi 2013).

5.4 Analysis of post-depositional fire alteration in mudbricks and earthen construction materials.

FTIR analysis have been further applied on mud-brick samples and earthen construction materials to supplement micromorphology analysis in the interpretation of post depositional alterations by fire and to prove if different colours in mudbricks and earthen construction materials may depend, not only on differences in raw materials used, but also on exposure to different temperatures (Forget at al. 2015; Friesem *et al*. 2014; Twiss *et al.* 2008; Berna *et al.* 2007). These data are fundamental to provide new insights into the formation processes occurred at the site and to analyse abandonment practices, which may support the reconstruction of settlement micro-history and socio-cultural practices, as examined in Chapter 6 and 7.

The analysis of IR spectra of mud-bricks and earthen construction materials compared with IR spectra of natural sediments and ceramic samples indicates alterations of clay spectra of architectural materials. According to experimental studies conducted by Berna *et al.* (2007), these alterations may be the result of materials exposed to elevated temperatures.

First the peak at 3600 cm^{-1}, which is prominent in the natural sediment analysed, is absent in architectural materials, with the exception of yellow mud-bricks deposit Type 2b, where this peak is moderately prominent (Fig 5.19 a). Second, the OH deformation band at 915 cm^{-1}, which is present in natural sediments, even if less prominent in the calcareous ones (Fig. 5.19 b, KVP16.01), is just a shoulder in yellow mud-bricks KVP13.4 (deposit Type 2b), in white mud-brick KVP13.16 (deposit Type 2c) and in earthen construction materials KVP14.29,32 (deposit Type 3), and it is completely absent in the other samples (Fig. 5.19 b). Both these evidences suggest that alterations of clay occurred on these samples, possibly due to exposure to fire (Forget *et al* 2015; Berna *et al*. 2007; Shoval *et al.*2011). According to studies conducted on experimental materials (Forget *et al.* 2015; Berna *et al.* 2007) these peaks begins to disappear with increasing temperatures and are generally associated with a shift to higher wavenumber of main Si-O band from 1030 cm^{-1} to 1040, 1050 cm^{-1}. However, the main Si-O stretching band in all the architectural materials is around 1000-1020 cm^{-1}, at lower frequencies than those observed in natural sediments, which are around 1030 cm^{-1}.

Architectural materials were compared with ceramic samples, which were used as reference materials to assess possible alterations by fire. The ceramic clay, which was exposed to elevated temperatures during the firing process, shows similar results than those observed in mud-bricks

and earthen construction materials, with the absence of peak at 3600 cm^{-1} and 915 cm^{-1}, and the Si-O peak at around 1010 cm^{-1} (Fig. 5.20).

Therefore, if we assume that architectural materials were possibly exposed to fire, on the basis of similarities with alterations observed in ceramic samples, the discrepancy with standard reference materials may possible derive from differences between clay types, and between pure clay, which is generally used in experimental studies aimed at analysing alterations by fire, and archaeological materials (Forget *et al*. 2015; Berna *et al.* 2007). It is important to consider that clay/sediment of archaeological materials may be mixed with other minerals, both of primary and secondary origin, as calcite, which may affect the grade of alterations of sediment and produce different results than those analysed and recorded in other contexts/studies (Weiner 2010, 303-306).

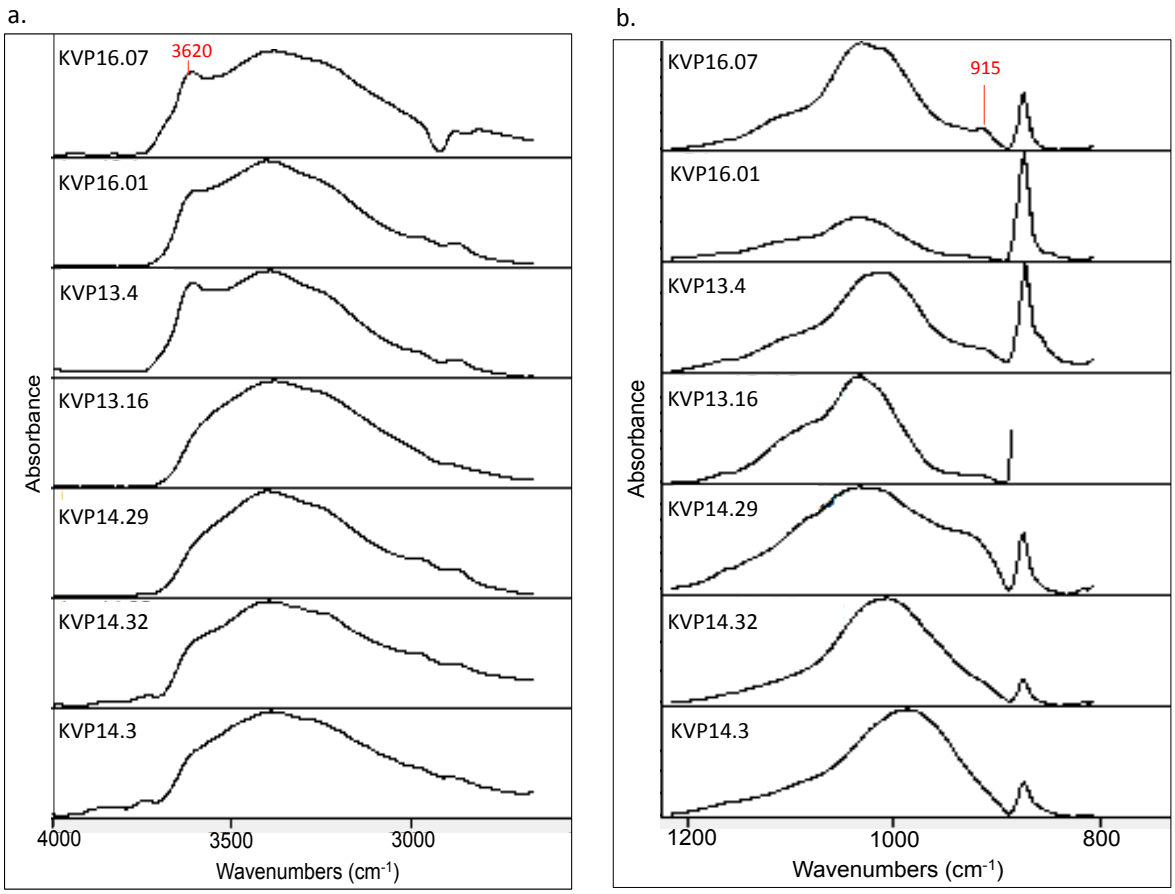


Figure 5.19 Spectra of natural sediments compared to mud-bricks and earthen construction materials. a) Spectra at 4000-3000 cm^{-1} region; natural sediments KVP16.07 and KVP16.01 shows peak at 3600 cm^{-1} as well as yellow sandy clay loam mud-brick KVP13.4, Type 2b. In white mud-brick KVP13.16, Type 2c and red construction material KVP14.29, Type 3, 3600 cm^{1} peak is completely absent, while is present as a weak shoulder in red construction material KVP14.32, Type 3 and red mud-brick KVP13.3, Type 2a. b) Spectra at 1000 cm^{-1} region; the OH deformation band at 915 cm^{-1} is present in natural sediments KVP16.07 and KVP16.01, even if less prominent in the latter. The same peak is just a shoulder in yellow mud-brick KVP13.4, Type 2b, in white mud-brick KVP13.16, Type 2c and in red construction material KVP14.29, Type 3, and it is completely absent in red construction material KVP14.32, Type 3 and red mud-brick KVP13.3, Type 2a.

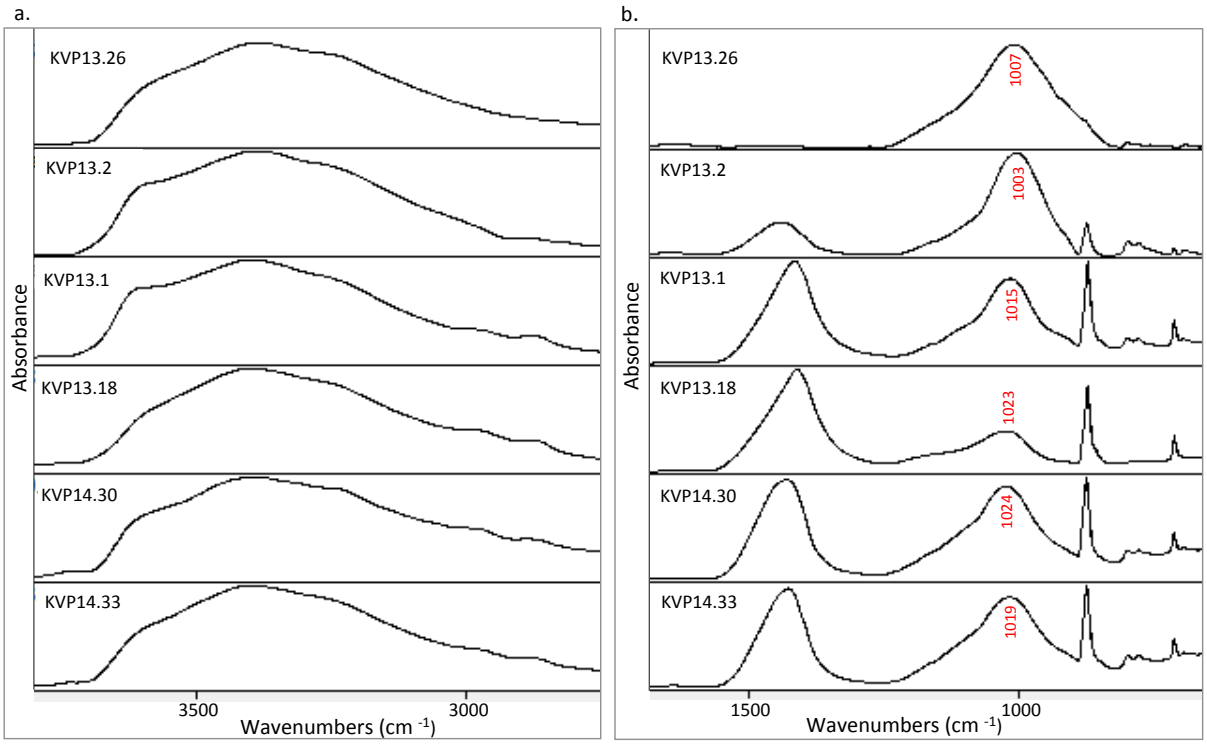


Figure 5.20 Spectra of Drab Polished ware KVP13.26 compared to mud-bricks Types 2a, 2b, 2c, earthen construction materials Types 3 and earthen wall plaster Type 4. a) Spectra at region 3600-3400 cm-1 show alterations of monmorillonite clay, visible in all samples by the absence of 3600 cm-1 peak, with the exception of red silty clay loam mud-brick KVP13.2, Type 2a and yellow sandy clay loam mud-brick KVP13.1, Type 2b, which show a weak peak in the OH stretching region; b) Spectra at region 1000 cm-1 show the complete absence of 915 cm-1 peak. Clay peaks at 1030 cm-1, in ceramic and earthen material samples do not shift at higher wavenumbers as suggested by experimental analysis on sediments exposed to elevated temperatures (Berna *et al*. 2007; Forget *et al*. 2015), but are at lower wavenumbers, between 1007 cm-1 in ceramic sample KVP13.26 and 1024 cm-1 in earthen wall plaster KVP14.30, Type 4.

FTIR results of mudbricks and earthen construction materials indicate that the study-materials have been affected by alterations by post-depositional fire, even though it was not possible to determine if diversity in colours between earthen architectural materials types may be related to differences in heath intensity and duration. Evidence of post-depositional fire alterations in architectural materials are even more interesting if contextualised to field and micromorphological data, which attest the occurrence of burnt layers overlying the last occupation surfaces of many building-units in Area A at Erimi-LtP, possibly resulting from deliberate firing of structures as part of abandonment rituals (see Chapters 6 and 7).

5.5 Conclusion and interpretation

5.5.1 Procurement strategies and accessibility to local resources

Combined microscopic and geochemical analyses of architectural materials and natural sediments supported the study of raw materials procurement and accessibility, and the investigation of technological choices, decision making and socio-economic organisation at Erimi-LtP (Arnold *et al*. 1991, 88; Neupert 2000).

Compositional analyses conducted on the study-samples revealed that a wide range of local materials were available within a range of 5km from the settlement area; these materials were selected and manipulated according to different 'recipes' in order to produce diverse architectural material products. The evidence analysed suggest that the selection of raw materials might have responded to 'specialising (procurement) strategy', according to the classification of this by Bishop *et al*. (1982, 32-60), as different raw materials were selected and used for producing different products types. The specialisation in material selections and modification, is also attested in the selection of tempers, which was observed both in earthen architectural materials and lime-plaster types.

Procurement of raw materials seems to have been based only on local resources. The results from materials analysed suggest that resource selection was not influenced by socio-political factors and to restriction and control over land and local natural resources. On the contrary, the differentiation in composition in constructional materials suggests that local resources were selected by builders on the basis of knowledge and perception of practical and functional choices as well as construction and artefacts types (see Section 8.4.1.2; Sillar and Tite 2000; Arnold 2000, 341-357).

5.5.2 Scale of production and organisation of building activities

The analysis of organisation of building activities and production was supported by the analysis of stone working, mud-bricks and lime-plaster manufacture.

As analysed in Section 5.3.4 the analysis of limestone technology revealed that the operations of carving and dressing building rooms and features, were possibly regularised and conducted by specialised workers, as suggested by the analysis of tooling marks that permitted to identify recurrent patterns in tools and techniques used, which may be ascribed to specialised skills.

The identification of specific recipes in mudbrick (see Fig. 5.13) and plaster productions (Section 5.3), the use of selected tempers to obtain diverse products (e.g. the use of ceramic tempers in lime plaster deposit Type 8a, to produce a hard and waterproofing materials to be

applied on mortar installations), suggest that the production was most probably by workers specialised in building tasks, as more widely discussed in Section 8.4.2.1.

5.5.3 Development in building technology

Macro-morphological analysis of mud-bricks recovered at the site suggests that both hand-shaped and mould-shaped mudbricks were produced at Erimi-LtP. The lack of standardisation in the production, as revealed by the absence of recurring sizes in mud-bricks recovered and analysed, does not always indicate a lower level of manufacture specialisation. In fact, the method of production may be affected by many variables including social, environmental and technological choices (Arnold 2000, 361-365) and developments in technology are not necessarily of uni-linear evolution (Matthews *et al*. 2013, 125-128). As briefly discussed in Section 5.5.2 and more widely analysed in Section 8.4.2.1 the presence of recipes identified in mud-bricks composition may furnish valid indication in support of manufacture specialisation in this industry.

Furthermore, data analysed in this chapter indicate an increase and improvement in lime-plaster production during the Middle Cypriot period. This is indicated by manufacture and use of fired lime-plaster types at Erimi-LtP. As examined in detail in Section 8.4.2.3, the production and use of specific lime plaster-types is an indication of the high technical skills and pytotehcnological development at Erimi-LtP, possibly as result of an improved labour specialisation and increased social complexity at the end of Middle Cypriot period (Bombardieri *et al*. 2013).

6. CONTEXTUAL ANALYSIS OF THE USE OF SPACE AT ERIMI-LAONIN TOU PORAKOU: the proposed productive area, Area A

6.1 Introduction

The aim of this chapter is to reconstruct the micro-history of Area A, the proposed productive area of the settlement of Erimi-LtP, from construction and use to abandonment of the structures, to analyse how space was used and transformed through time. Anthropological studies of the use of space have illustrated, how space is endowed with meaning through practices and activities, which are informed by and therefore representative of socio cultural behaviour (Bourdieu 1977; Matthews *et al*. 1996).

The dialogue between field excavation approaches, geoarchaeological, archaeobotanical and architectural analyses has been particularly stimulating in the definition of a valid methodological approach both in the Erimi-LtP project and in this thesis as discussed in the Methodology chapter (see Section 2.1). This synergy has contributed to definition and compilation of a multi scalar data-set to enable and support both the reconstruction of the settlement history and more broadly the analysis of social-cultural dynamics and developments of the recent Cypriot prehistory.

In the Erimi-LtP project and in this thesis the analytical technique of micromorphology is incorporated into a well-integrated research programme, in order to examine and compare results and interpretations from stratigraphic sequence of field deposits and of different artefact types with those from microscopic analyses of microstratigraphic sequences and archaeobotanical data, when available. Micromorphology is used here as a high-resolution contextual analytical tool to examine the types of floors and surfaces, to analyse the impact of activities on the surfaces and identify artefactual, bioarchaeological and sedimentary traces of activities. Archaeobotanical analysis are not part of my personal contribution but are included in this thesis under licence from the project director and archaeobotanists working at the site. Archaeobotanical data have been included in the thesis data-set since plant remains are important indicator of the use of space, and therefore these data may be used as comparative evidence to field and micromorphological analyses. Analyses of other archaeological remains as shells and animal bones, identified through dry screening (1/4, 1/8 in. mesh), were not included in the thesis data-set as they are still pending, but will be considered in future analysis in order to broaden the existing evidence and enhance the reconstruction of past activities at the site.

This methodological framework was applied in order to obtain an interdisciplinary data-set to analyse spatial and temporal variation in use of space at Erimi-LtP. Moreover, the integration of micromorphological and stratigraphic analyses, which only principally differ in the greater resolution of the former, provides an efficient analytic tool to address some of the sampling limitations of micro-analysis by linking the results with larger scale field-observations. This multi-scalar approach also enables assessment of any biases that may arise in semi-arid regions with shallow stratigraphy and scarce preservation of the deposits, as Erimi-LtP (see Section 4.2; Matthews and French 2005; Boivin and French 1995).

In order to enable a critical approach and contextualisation of the human activities at the Middle Bronze age site of Erimi-LtP, this chapter examines the thesis data and other interdisciplinary data analysed at the site according to spatial type by settlement areas, spaces (open and roofed) and building-units (Table 6.1).

Table 6.1 Distinctive characteristics of open spaces, semi-open spaces and roofed buildings.

OPEN SPACES	• Not carved into the foundation bedrock floor • No prepared floors. The foundation bedrock was used directly as floor
SEMI-OPEN SPACES	• Carved 20-30 cm deep into the bedrock floor • Not completely enclosed by limitation wall structures • No prepared floors. The foundation bedrock was used directly as floor
ROOFED BUILDINGS	• Carved 50-60 cm deep into the bedrock floor. • Completely enclosed by limitation wall structures • Multiple layers of floor plaster.

The detailed micromorphological descriptions of deposit-types are presented and discussed in Chapter 4, in examination of the different material and occupation types at Erimi-LtP. Full micromorphological descriptions are presented in Appendix C. Key characteristics are selected in the descriptions below to support and built interpretations and arguments. This chapter examines the significance of these materials and occupation deposits with regard to their spatial and temporal locations and context to investigate the history of particular areas. The wider ecological, social and economic significance of these are explored in the discussions, Chapter 8.

The analysis of each building-unit begins with the study of the macroscopic architectural data, to examine the syntax and geometric aspects of the built space including building-unit and room placement, orientation, size and shape and location of doorways as access points (Fisher 2007; 2009a; Cutting 2003).

This is followed by macroscopic and microscopic contextual analysis of construction materials for walls, in order to study possible similarities and differences in material selections and building practices, which may be related to different socio-cultural choices, and roles and representation of buildings (Love 2011; 2012; 2013; Matthews 2005a). Macroscopic field observations are presented in plain text, and micromorphological deposit types and micro-analytical data and interpretations are presented in italics, in order to distinguish between the different scales of analysis in the presentation of the results.

The nature and history of individual interior spaces are then analysed by examination of the type, number and form of architectural installations, artefacts on floors, followed by and integrated with archaeobotanical data recovered by flotation of the deposits identified in the field within installations and vessels.

Architectural installations and artefacts have been classified in three macro-categories: fixed elements, semi-fixed elements and portable objects. Fixed elements comprise those feature that, once built cannot be moved or transported, as fixtures and architectural installations; semi-fixed elements include big objects as pithoi or querns, which are difficult to move once placed in a building/room; portable objects comprise small vessels and small working tools, which may be easily transported from a space to the other (Table 6.2; Fisher 2007; 2009a). Each of these categories gives important clues about the use of the space analysed and contributes to define socio-cultural choices of social agents at Erimi-LtP.

Table 6.2 Table showing the three macro categories used to classify architectural installations and artefacts.

FIXED ELEMENTS	• Bins/pits, mortars, basins, hearths/ovens, benches, emplacements
SEMI-FIXED ELEMENTS	• querns and rubber stones • large ceramic vessels: pithoi; storage jars; amphorae
PORTABLE OBJECTS	• small ceramic vessels: bowls, basins, juglet, jug, cooking pot • ceramic objects: spindle whorls, loom weights • stone objects: ground stone tools, chipped stone tools, picrolite tools

It is argued in this thesis that floors and occupation deposits are sensitive markers of the spatial and temporal variation in the use of space and activities carried out in the buildings analysed (see Section 1.2.2; La Motta and Schiffer 1999; Schiffer 1987). The micromorphological analysis of floors and occupation deposits is integrated with comparative geochemical analyses, to contribute to the identification of the floor plaster composition and manufacture (see also

Chapter 5). Micromorphology analysis of sequences of floors and micro residues were conducted to investigative variation in the creation and use of space within the building-units.

These integrated data-sets are examined here to provide independent interpretations of each interior space according to the architectural elements and artefactual and archaeobotanical data for comparison to macroscopic and microscopic analyses of the floors and occupation sequences. This approach enables greater evaluation of the strengths and weakness of each data-set, the different temporal resolutions that they represent and the potential for integrating and combining them in interdisciplinary multi-scalar analyses of the micro-histories of early settlements.

This multi scalar data-set is presented in a chronological sequence, from the early occupation Phase B, to the subsequent Phase A, in order to analyse the temporal variations in architectural layout, micro-stratigraphic sequences and use of space within buildings in Area A.

Abandonment dynamics are subsequently analysed on the basis of microstratigraphic and micromorphological evidence collected from the probable productive area A, where the stratigraphic sequence of upper deposits is better preserved.

Finally, a first level of interpretation and discussion of results is presented after the analysis of each building-unit.

The following sections examine geographically in turn: Area A open areas (6.2), then the interior spaces: building-unit SA I and annex WA V (6.4); building-unit SA IIa and annex SA IIb (6.5); building units SA III (6.6) and SA VI (6.7) to examine spatial and temporal variations in architectural practices, activities and use of space, as small scale-everyday activities and routines have a fundamental role in the analysis of wider social, cultural and economic trends (see Section 1.2.2).

6.2 Area A: an overview.

Area A, the probable productive area of the settlement, was constructed on the top of the hill and organised with a distinctive layout, characterised by five open and semi-open areas and six building-units, constructed as single rooms (Amadio and Chelazzi 2013). Analysis of access patterns of this overall area (Fig. 6.3) indicates that Area A was planned and constructed in order to be fairly permeable from the outside. Semi-open areas were accessible from the large open space, WA IV; while building-units were designed to have a direct access to the surrounding passageway.

Before discussing interpretation of space use, it is important to consider that a factor affecting all archaeological discussions and comparisons of open areas and interior units is the potentially differential preservation of floors and stratigraphic sequences in these contexts. The proposed open areas were built directly on the natural surficial bedrock floor, and were not carved into the bedrock floor unlike interior units. Semi-open areas were only slightly carved into the bedrock floor, but at an inferior depth to interior units, approximately 30 cm and >50 cm deep respectively (see Table 6.1 and microstratigraphic columns, Fig 6.4). Deposits in open and semi-open areas thereby were more elevated, less enclosed than interior sequences and were more exposed and subjected to erosion and soil movement by natural agents. The predominant deposits evident in the field comprise brown sandy clay loam topsoil, 20-30 cm thick. By contrast the building-units were carved into the bedrock floor to a depth of 50-60 cm. Thereby they functioned as 'containers' of deposits and artefacts that were often better preserved and more protected below collapsed building materials and deposits *in situ* and less susceptible to degradation and dispersion by subsequent erosion that has affected open areas more (see Section 4.3). Floor sequences in interior spaces, by contrast tend to be 12 cm to 20 cm deep.

Despite this sparsity of data from the upper stratigraphic levels in open areas, it was possible to identify marked differences between stratigraphic sequences in open areas and within buildings.



Figure 6.1 Aerial photo of Area A, with indication of open-spaces (WA I, IV), semi open-spaces (WA II, III, V) and building-units (SA I-VI).

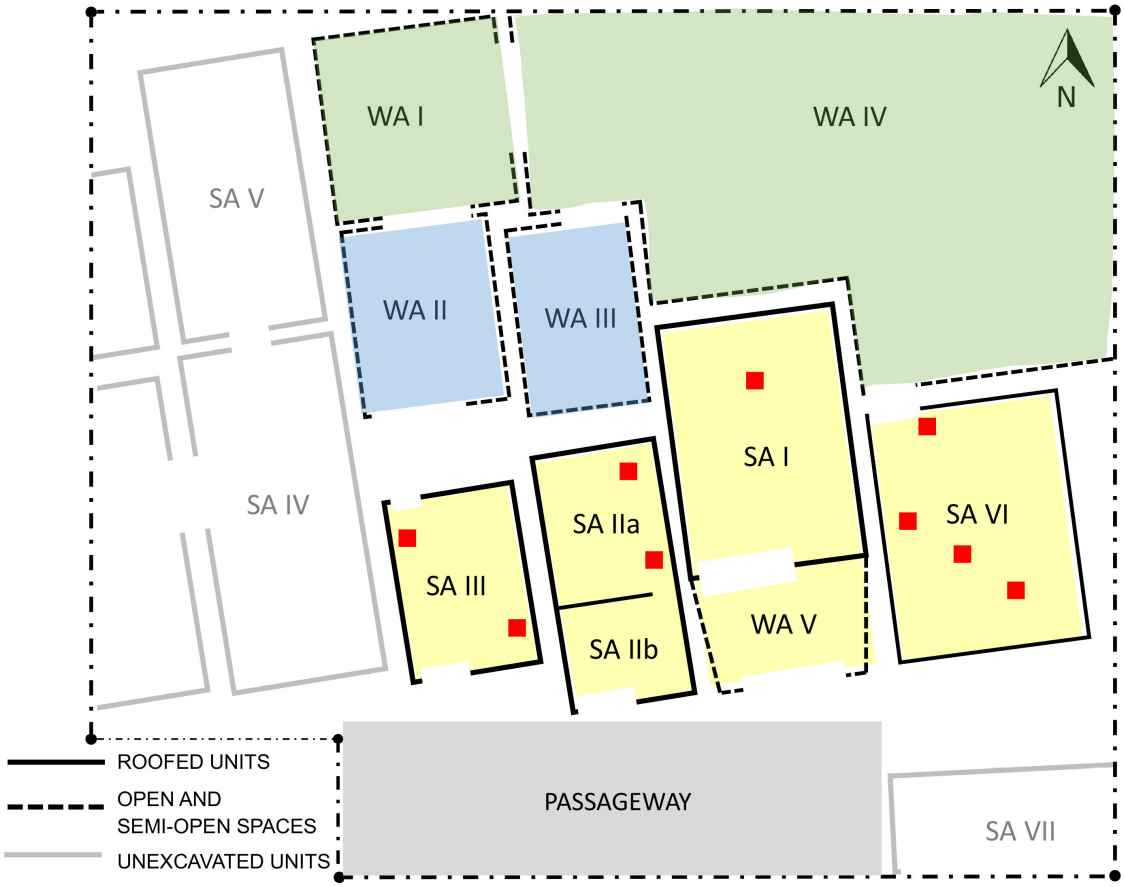


Figure 6.2 Schematic plan of Area A. Building-units analysed are coloured in yellow; semi-open spaces in blue and open spaces in green. Red squares show the location of undisturbed micromorphological blocks.

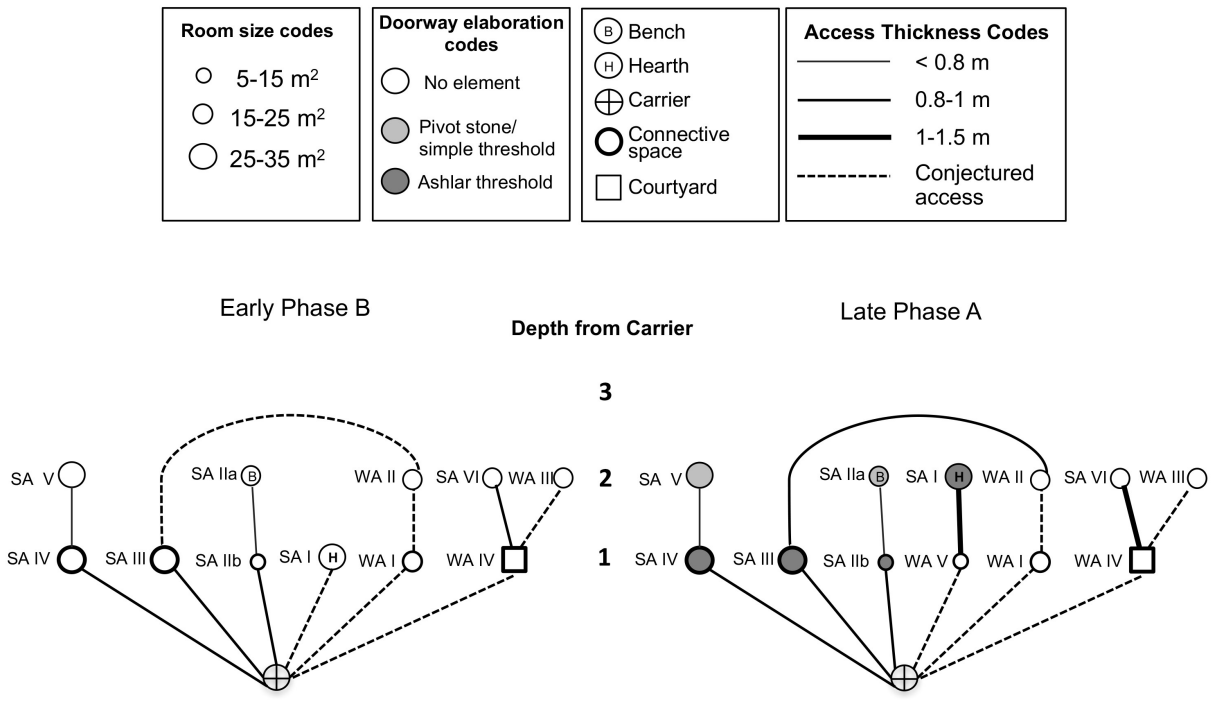


Figure 6.3 Justified Access graph of Area A. The Early Phase B is represented on the left; the later Phase A on the right. The graph is coded for room size, doorways elaboration and access thickness.

Table 6.3 Area A, Phase A ranking of key syntactic and architectural properties of contexts analysed. Control Value (CV), Relative Asymmetry (RA) Mean Depth (MD) and Convexity values were calculated according to Hillier and Hanson (1984, 143-175) and Fisher (2009, 440-446). Doorway elaboration was calculated on the basis of following ranking: no element = low; pivot-stone/simple threshold = medium; ashlar threshold = high.

Control value			**Relative Asymmetry**				**Convexity**		**Doorway elaboration**	
Context	CV	Rank	Context	RA	MD	Rank	Context	Score	Context	Rank
Carrier	2.3	High	Carrier	0.10	1.6	Low	Carrier	-	Carrier	-
WA IV	2.5	High	WA II	0.439	3.41	Medium	WA I	1.62	WA I	Low
WA I	2.5	High	WA III	0.418	3.3	Medium	WA II	1.12	WA II	Low
SA IIb	1.2	Medium	SA I	0.418	3.3	Medium	WA III	0.5	WA III	Low
SA IV	1.2	Medium	SA IIa	0.418	3.3	Medium	WA IV	0.46	WA IV	Low
WA V	1.2	Medium	SA V	0.418	3.3	Medium	WA V	0.75	WA V	Low
WA II	1	Medium	SA VI	0.318	2.75	Medium	SA I	0.71	SA I	High
SA III	0.7	Medium	WA V	0.257	2.41	Low	SA IIa	0.76	SA IV	High
SA I	0.5	Low	SA IIb	0.257	2.41	Low	SA IIb	1.5	SA IIb	High
SA IIa	0.5	Low	SA IV	0257	2.41	Low	SA III	0.83	SA III	High
SA V	0.5	Low	WA I	0.287	2.58	Low	SA IV	0.56	SA V	Medium
WA III	0.5	Low	WA IV	0.166	1.91	Low	SA V	0.54	SA IIa	Medium
SA VI	0.3	Low	SA III	0.23	2.3	Low	SA VI	0.69	SA VI	Medium

Table 6.4 Architectural and syntactic properties of types of social interaction. After Fisher 2009, Table 2, 448.

GATHERINGS
- Medium to high Control Value (space is controlling)
- Low Relative Asymmetry measure (Space is accessible/well integrated)
- Low convexity score (space will tend toward being long and narrow)

PUBLIC –INCLUSIVE OCCASIONS
- Medium to high CV
- Low RA
- High convexity score (>0.6) and area >12 m^2 (space will be large and tend toward square)
- Low Mean Depth measure
- Space is more likely to contain important fixed or semi-fixed elements (e.g. ashlar masonry, formal hearth, etc.)
- Likely to have wider doorways

PRIVATE –EXCLUSIVE OCCASIONS
- Low CV (space is less subjected to intrusion)
- Medium-high RA (space is not easily accessible)
- High Mean Depth
- Likely to have more narrow doorways

Evidence from open and semi-open areas identified and excavated in Area A is examined in Section 6.3. Of the six-identified building-units of Area A, four buildings that have been completely excavated and analysed are examined in this Chapter: SA I and annex WA V, SA IIa and annex SA IIb, SA III and SA VI. A total of 9 undisturbed blocks have been collected from representative sections within these building-units (see Fig. 6.2), and 11 related thin

sections from these blocks have been analysed. 32 smaller block samples were collected from 1) representative architectural materials including wall mud-bricks and earthen wall plaster from collapsed structures, as these materials are rarely preserved in situ in the shallow deposits at Erimi-*Laonin tou Porakou;* 2) representative structures of features including hearths and basins made of or coated with plaster, including those excavated prior to the thesis.

6.3 Area A. Open and semi-open areas: spatial layout, features, artefacts and floors.

Open and semi-open areas were placed on the northern section of the hill top, in a position more exposed to winds coming from the North, possibly to take advantage of cool breezes, especially during the hot season (Wright 2009; Carrera *et al*. 2009). As discussed above, open areas, were built directly on the natural surficial bedrock floor and were not carved into the bedrock floor. Semi-open areas, unlike open ones, were slightly carved into the bedrock floors, but not completely enclosed as interior buildings (see Table 6.1).

The northern section of Area A was organised with a planned spatial layout (Figs. 6.1; 6.2). Two open areas were placed on the northernmost limit of Area A: WA I and WA IV; these were organised in order to be well integrated within the settlement layout and easily accessible to anyone, and thereby used as open courtyards (see Tables 6.3, 6.4). Two semi-open areas, WA II and WA III, were constructed in order to be aligned and parallel oriented with the interior buildings to the south, and the archaeologists presume may have been covered with perishable structures. They were directly accessible from the two open-areas, and were possibly addressed to function as public working spaces (Medium/Low Control Value; Medium Relative Asymmetry; see Table 6.3, 6.4).

Open areas WA I and WA VI were rectangular shaped and were oriented East-West, defined by the surrounding architecture. Area WA VI measures 15 x 7 m (105 m^2), and is connected to the west with WA I, of 6.5 x 4 m (26 m^2). Semi-open areas WA II and WA III are rectangular, north-south oriented like roofed buildings, and smaller in size than open areas, measuring approximately 5 x 3-4 m (18 m^2). The access to these semi-open areas was presumably on the north side, leading into the two open-areas, as shown in the schematic plan, Figure 6.2. Space WA II was also accessible on its southern side, in connection with the building-unit SA III as illustrated in the access graph Figure 6.3.

90% of the working features, placed in open and semi-open areas, were constructed as squared and circular basins carved into the bedrock floor and coated with a hard, pale brown sandy clay loam plaster, probably fired lime that is characteristically hydrophobic. Other features comprise

3 m long shallow channels, carefully carved into the bedrock floor, in order to slope towards the basins, possibly to collect liquids and/or rainwater (Bombardieri *et al*. 2014a). Artefacts *in situ* are almost absent, with the exception of a bowl, associated with a dolerite pounder, found on the bottom of a circular basin in WA IV, possibly used to process products. Other objects recovered from the topsoil, include different stone tools, as pestles and axes, but also small ceramic tools as loom weights and spindle whorls. The form and surface materials suggest that open spaces were multifunctional working areas, where possibly activities involving the use of liquids or/and the collection of rain water were carried out (Bombardieri *et al.* 2014a).

To date, no deliberate prepared floor has yet been identified in open areas. The absence of prepared floors in open areas, based on field observations, is in contrast to that observed in the field and analysed using micromorphology in roofed areas, where the sequences studied comprise deliberately laid floors, as presented in Sections 6.4, 6.5, 6.6 and 6.7 (Fig. 6.4).

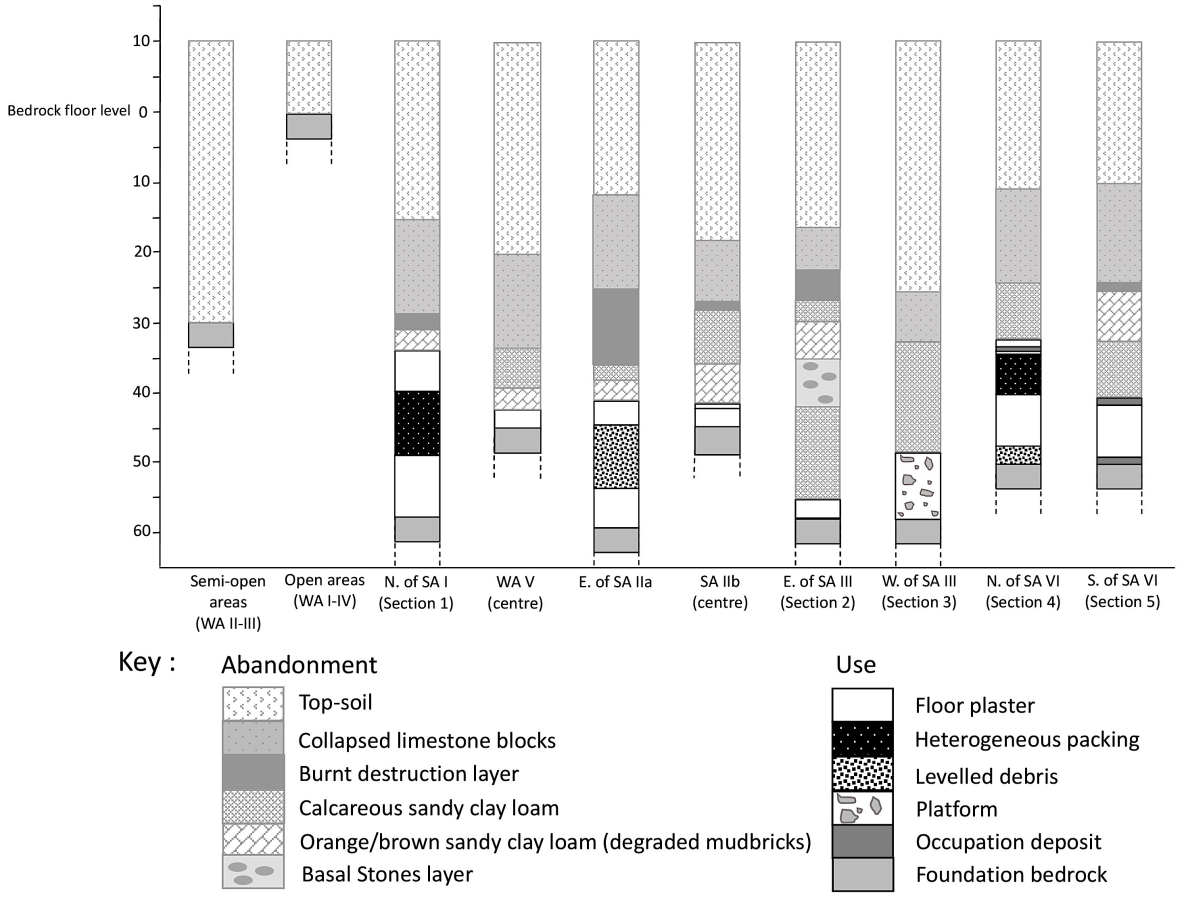


Figure 6.4 Microstratigraphic columns illustrating the type, thickness and frequency of floors, occupation deposits and destruction layers in semi-open and open areas and within building-units.

6.4 Area A. Building-unit SA I and annex WA V: spatial layout and construction

Building-unit SA I, in the middle of the area exposed to date (Fig. 6.1), is one of the larger interior units in Area A, at 35 m^2. The building-unit was originally carved, approximately 60

cm deep, into the bedrock floor in a roughly rectangular shape with carefully carved right angle corners (Amadio and Chelazzi 2013; Bombardieri *et al*. 2014b). A 60-70 cm wide edge of the original surface of foundation bedrock of marly miocene limestone, into which interior spaces were carved (deposit Type 1), was used as an elevated stable base, 60 cm high, on which to build the standing walls. These upper sections of walls were constructed of three-four courses of dry-stone limestone blocks and then earthen materials, as in the other building-units of the settlement (see Fig. 4.2).

The syntactic and architectural characteristics of SA I (see Table 6.3), suggest that this building-unit was organised in order to be fairly permeable from the outside, with a direct access from the external lane during the early Phase B and connected to a small entrance room constructed in the later Phase A (Fig 6.2). In addition, its size and its high convexity score (0.714), indicates that SA could host public-scale inclusive gatherings, possibly connected to diverse working activities, as illustrated in Table 6.4.

The access to unit SA I was placed on the south-western corner, as also in units SA II and SA III. This repeated layout suggests a degree of shared planning in organisation of the built space (see Section 8.5.1; Fisher 2009; Parker Pearson and Richards 1994, 1-34). This access connected SA I to the adjacent small annex WA V of 12 m^2, 4 x 3 m, which was used as open-space in the early Phase B, and turned into a small entrance room in the later Phase A.

Building-units SA I and WA V are characterised by two distinct phases of occupation, each marked by construction of a series of architectural installations, laying of a new floor and deposition of artefacts. These architectural elements are highly representative of activities carried out in the unit, as represented in the cladistic diagram Figure 6.26, and informative of the transformations in the use of space between the two occupational phases, as illustrated in the stratigraphic Tables 6.6 and 6.7. The two tables report the evidence recovered and analysed in building SA I and annex WA V following the stratigraphic sequence, from the basal entry to construction and use of the structures, and abandonment and post-abandonment. Field interpretation are examined first to present hypothesis of possible uses and functions of associated macro and micro materials, on the basis of key indicators from comparative ethnographic and microstratigraphic research reported in Table 6.5.

Table 6.5 Sets of key indicators characteristics of activities within buildings in different environmental and sociocultural contexts, on the basis of ethnographic and archaeological data (David and Kramer 2001; Matthews 2000; Milek 2012; La Motta and Schiffer 1999; Boivin 2000)

Activity	Fixed and semi-fixed elements	Portable objects	Surfaces attributes
Cooking	Hearth-Oven	Cooking pot Bowl	Thick coarse plaster (sandy clay loam, sandy silt loam) Burnishing the surface
Processing	Mortar Quern/rubber stone Basins?	Stone tool (pestle, pounder, axe etc) Spindle whorl and loom weight	Thick coarse/medium plaster (sandy clay loam, sandy silt loam, sandy clay loam) Burnishing the surface
Storage	Emplacement Basin/pit Pithoi and big storage vessels	Small closed vessels (for liquid preservation)	Thick sandy silt loam silty clay with added vegetal stabilizers.
Reception/clean	Sleeping benches	-	Thinner fine plaster (silt-loam, silty clay). Occasional presence of white finishing coats. Impressions of mats/rugs or wooden planks on plaster White wall plaster, often in multiple layers (seasonal whitewash)
Ritual	Areas associated with ritual features as altars, symbolic sculptures, wall painting or graves.	Zoomorphic vessels Prestigious objects Symbolic objects ? Personal object	Multiple layers of well prepared plaster (silty clay loam), often with white finishing coat. Occasionally painted. Impressions of mats/rugs White wall plaster. Occasionally painted

Table 6.6 Stratigraphic sequence of deposits analysed in building SA I. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Macro and micro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	Orange/brown, sandy clay loam including architectural materials, ashes and burnt debris and stone debris [354, 351]
Use - Phase A	- Cooking/Heating	Fixed elements: Hearth in limestone slabs (Ft. 4) with burnt deposit of ashes and charred matter in the firing chamber. Portable objects: Modified Jug used as prop for cooking pot Modified spouted basin 1 Cooking pot *Micro-material: 30% Silty size charred particles, accumulated into the porous microstructure of floor plaster KVP13.15, possible soot.*
	- Storage	Fixed elements: 3 Emplacements in limestone blocks and plaster (Fts. 1-3) Semi-fixed elements: 5 pithoi, (4 RP, 1 DP)
	- Processing	Semi-fixed elements: 2 dolerite grinders Portable objects: 3 cherts, 1 picrolite pointed tool

	-Textile activity	Portable objects: 1 spindle whorl 1 limestone weight
	-Transporting	Portable objects**:** 6 small bowls 1 DP pyxis, 1 RP small spouted jug associated with DB pithos 2 DP jugs 1 RP juglet
Construction - Phase A	- Walls	Partition limestone-wall (W2) Limitation wall (W1)
	- Doorway	Monolithic limestone threshold (D. 5)
	- Floor	*Pale brown, fine sandy clay loam* ***Plaster floor*** *(KVP13.15, [360], Type 9c)*
	- Packing	*Constructional packing with 40% charred material (made with secondary refuses ([459], Type 10b)*
Use – Phase B	- Cooking/Heating	Fixed elements: Circular hearth made of silty clay loam plaster (Ft. 42)
	- Storage	Fixed elements: Circular pit carved into the bedrock and plaster floor (Ft. 45) Semi-fixed elements: 2 RP Fragmentary storage jars
	- Processing	Fixed elements: Double basin carved into the bedrock and plaster floor (Ft. 43) Circular basin carved into the bedrock and plaster floor (Ft. 48) Circular mortar carved into the bedrock and plaster floor and coated with *silty clay plaster* (Type 3a) (Ft. 44). Portable objects: 1 dolerite pounder 1 dolerite pestle 1 dolerite anvil 1 fragmentary spindle whorl (decorated) 2 picrolite tools Archaeobotanical remains: Boraginaceae nutlets in deposit of basins Ft. 43,48
Construction- Phase B	- Walls	*Red-silty clay loam bricks (Type 2a); yellow-fine sandy clay loam (Type 2b)* *Yellow mud-plasters with red painting (Type 4)*
	- Floor	*Pale brown, fine sandy clay loam* ***Plaster floor*** (*KVP13.14 [461], Type 6c*)
Foundation bedrock floor [302]		

Table 6.7 Stratigraphic sequence of deposits analysed in annex WA V. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Macro and micro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	Brown sandy clay loam including architectural materials and stone debris [391, 392]
Use - Phase A	- Reception/ entrance space	Clean floor with no installations and artefacts associated.
Construction - Phase A	- Walls	Limitation wall (W1)
	- Doorway	Monolithic limestone threshold (D. 5)
	- Floor	*Pale brown, fine sandy clay loam* ***Plaster floor*** *([393], F.12, Type 9c)*
	- Packing	Pale brown, calcareous, sandy clay loam constructional packing [394]
	-Infilling	Yellow, calcareous sandy clay loam infilling Phase B basins, [400, 406]
Use-Phase B	- Processing)	Fixed elements: Squared and circular basins carved into the bedrock floor (Fts. 37, 38)
Construction- Phase B	- *Floor*	**Bedrock floor** used as floor ([302], F.16)

6.4.1 Walls construction and materials

The earthen brick walls were built on a base of limestone blocks and slabs, 3 courses deep, 30-40 cm high, set directly on the foundation bedrock, as illustrated in Figure 4.2. The few earthen bricks identified on the site were possibly hand-shaped, similar to building practice in traditional and vernacular Cypriot architecture of modern villages (Obafemi and Kurt 2016; Philokyprou and Michael 2012; Ionas 1988). However, the limited number of bricks preserved on the site, did not permit confirmation of this hypothesis with absolute certainty, as examined in Section 5.3.2

Comparative XRF analysis of selected natural sediment samples and brick sub-samples indicates that the eastern limit wall W1, which adjoins building- unit SA VI, was constructed with mud- bricks made of red silty clay loam from terra rossa/fusca deposits (deposit type 2a); while a yellow, sandy clay loam from weathered miocene marl material (deposit Type 2b), was used on the western wall, adjoining the smaller unit SA IIa. It is unclear if the use of diverse materials in the eastern and western wall of the unit may be related to different episodes of construction and renovation of the unit structures, as mudbrick walls require constant maintenance and repair, or to differences in accessibility and exploitation of local resources and changes in sociocultural behaviour (Matthews 2005b, 364-365), as the earthen bricks studied were collected from collapsed structures since brick walls at Erimi-LtP are not preserved in-situ.

A 2cm thick yellow/orange, earthen wall plaster (deposit Type 4) was applied on the external face of the south facing mudbrick wall to protect the unit structure, as identified in the field. This external 'render' was also used as means for social representation. In fact, *micromorphological analysis has enabled identification of the presence of thin layer of red paint (deposit Type 6) on top of the external face of this wall earthen-plaster, masked below a layer of calcite, possibly post-depositional in origin (see Sections 4.4.6 and 5.2.3).*

It is interesting to note that the red-brown painting was applied on the south wall of the building-unit SA I, where the entrance to the unit was placed, possibly with the intent to emphasize the role of the building and passage into it, enhancing its symbolic aspects and engendering a 'sense of place', as also recognised by ethnographic studies and analysis of cognitive psychology (e.g Jones 2004; Jones and Macgregor 2002).

6.4.2 Building-unit SA I, Early Phase B: Architectural installations and artefacts.

In the early occupation Phase B, the space of SA I was not internally divided by partition elements, and the room was furnished with a series of basins carved into the foundation bedrock floor and plastered with a pale brown, sandy clay loam plaster. The largest of these basins is a

double installation (Ft. 43) formed by a system of two interconnected basins, one squared (dimension: 1,08 x 0,9 m., depth 16 cm.) and one circular (diameter: 42, depth 54 cm.), which was built in the middle of the room.

A dark brown, silty clay loam organic-rich deposit had accumulated at the bottom of the circular basin. Archaeobotanical analysis identified mineralised nutlets pertaining to Boraginaceae species (>100 nutlets) within this deposit. However, since no undisturbed micromorphological blocks, representative of this deposit, were collected, is still uncertain if the botanical material may be considered residues of processing activities, possibly pertaining to the maceration of organic products or may represent secondary refuse, deliberately accumulated within the basin at the end of its use. This second hypothesis may be supported by the fact that botanical residues are preserved by mineralisation, a phenomenon, which is generally more frequent in midden-like deposits and rubbish pits, where the high concentration of calcium and phosphate from organic material and faecal matter, favours the replacement by calcium phosphate of organic tissues (Shillito and Almond 2010). However, Boraginaceae nutlets may be naturally mineralised due to the natural $CaCo_3$ and silica content of the seeds (Asouti *et al*. 1999). In addition, similar organic-rich deposits have been also identified in another deep basin (Ft. 46; diameter 28 cm, depth 40 cm) located westwards the double basin, where a higher occurrence of mineralised Boraginaceae nutlets have been analysed (>3000 nutlets, Scirè-Calbrisotto *et al.* 2017). Hence, on the basis of these further evidence it was possible to suggest that their presence was not accidental. Presumably, selected plants were collected, deliberately accumulated and processed in these designed installations, possibly for dye extraction, as Boraginaceae plants are also well known in Cyprus for their dyeing properties (Vassio and Bombarideri 2014; Scirè-Calabrisotto *et al.* 2017).

The north-western area of the unit was possibly assigned to a storage function, based on the presence of a circular pit (Ft. 45; diameter 64 cm; depth 70 cm), carved into the bedrock floor. The yellow, calcareous sandy clay loam infilling, was floated and analysed; however, no significant concentration of charred organic materials was observed by archaeobotanists. In proximity to the double basins Ft. 43 and closed to the storage pit, two RP fragmentary storage jars have been identified. The pit's presence may possibly support the idea that storage facilities, even if at small scale, were present in this unit, during the Early Phase B.

The multifunctional character of unit SA I during the earlier occupation phase B, is marked by construction of circular hearth/oven (Ft. 42; internal diameter 1m, external diameter 1,26 m), placed in the south-east corner of the room, close to the entrance, possibly to favour the

evacuation of fumes, considering the possible limited occurrence of windows and other openings. The hearth/oven installation was made of unfired sandy clay loam plaster with a dark brown silty clay floor [470], with two circular settings to allocate pots during the firing activity. Residues of fuel have not been identified on the hearth floor, with the exception of silty size charred matter and small flecks, embedded in the hearth plaster floor, suggesting that possible maintenance activities, as sweeping and dumping the fuel residues, were constantly carried out (Fig. 6.5; Miller *et al*. 2010). The circular hearth/oven was associated with cooking and/or heating activities, which were presumably functional to a series of duties, possibly including also dyes extraction, as suggested by studies on dyes and textile production on Bronze Age Cypriot contexts (Muti 2015, 192-199). Similar circular, plaster hearths have been identified both within domestic rooms at Marki-*Alonia* (phase D and E, respectively corresponding to the EC I-II, EC III; Frankel and Webb 2006, 14-17) as well as in exterior areas in the Middle Cypriot industrial/productive site of Kissonerga-*Skalia* (Crewe and Hill 2012).

A circular installation (Ft. 44; diameter: 33 cm; depth: 24 cm) was carved into the bedrock floor, next to the circular hearth, on its eastern side. This circular feature is characterised by a basal stone set at its base. The placement of a dolerite pounder, on the base of this feature, suggest that the installation was possibly used as mortar, as also proposed by Frankel and Webb, for similar structures, named as 'emplacements', identified within buildings and open spaces at Marki-*Alon*ia (Frankel and Webb 2006, 12-14; Frankel and Webb 1996, 69-70).

Micromorphological analysis of Sample KVP13.5 from the internal surface of mortar FT.44, indicates that the circular installation was coated with a thick layer of silty clay lime plaster tempered with 30% ceramic materials ([477], deposit Type 8a). The composition of plaster coating is deliberately different from the associated floor plaster, sample KVP13.14, which by contrast was rendered using a pale brown coarser sandy clay loam, rich in limestone sands (deposit Type 9c) (Fig. 6.5 c, d). FTIR analysis on sub-sample of KVP.15.5, confirmed that the plaster used to coat the basin is a pyrotechnological product, which was manufactured through the firing of local limestone (possibly havara), reduced to powder (quick lime), slaked with water and mixed to aggregates. 30% ceramic materials were deliberately added to the lime plaster, possibly to make the product more resistant to mechanical stress or/and confer it hydraulic properties as proposed by analyses of similar plaster in Cyprus (Philokyprou 2012a, 2012b; Turco et al. 2016) and near East contexts (Regev et al. 2010; Moropoulou et al. 2000).

This evidence on tempering and manufacture of plaster materials, suggests that the technological knowledge and organisation of building practices were notably developed at Erimi-LtP from at least the early phase of occupation, as discussed in Section 8.4.2.3.

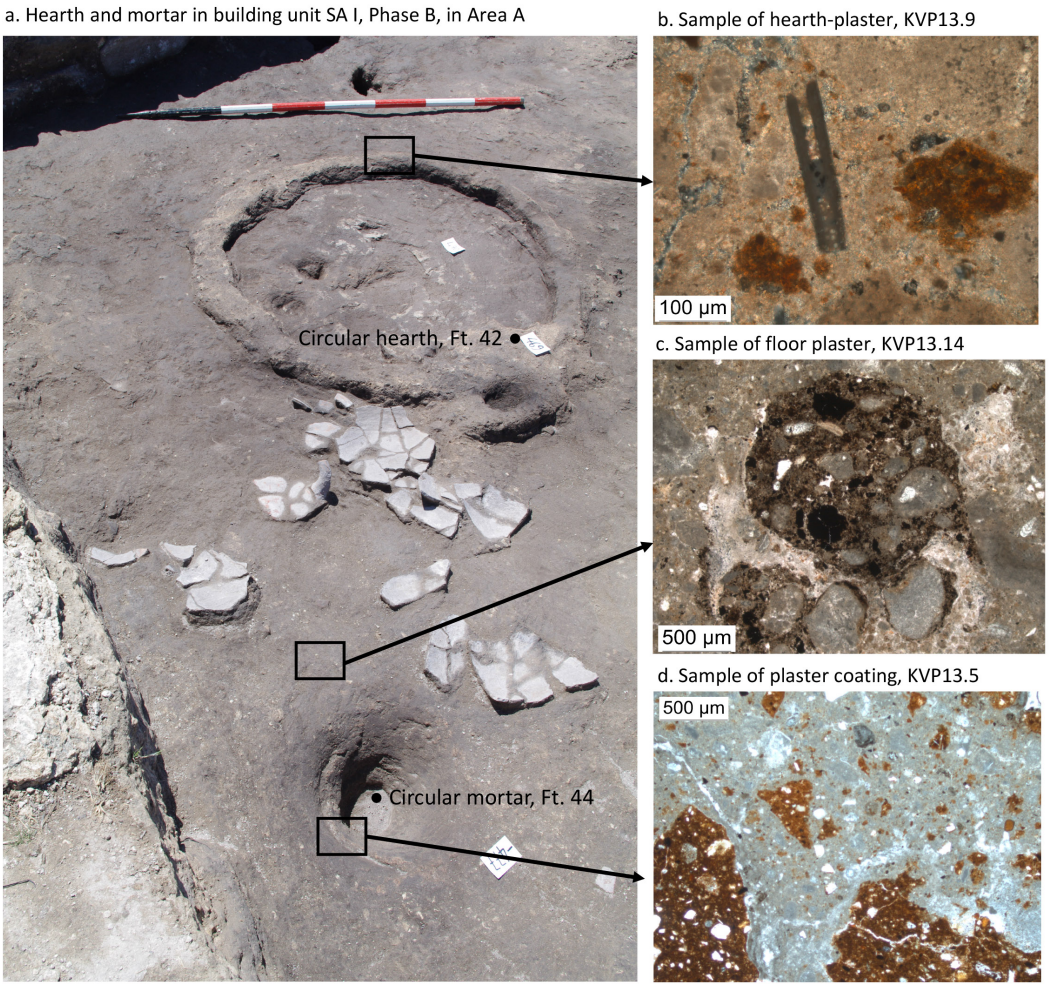


Figure 6.5 a) South-eastern corner of building-unit SA I with circular hearth Ft. 42, circular mortar Ft. 44 and trampled ceramic shards; Phase B; b-d) Photomicrographs of small samples collected from fixed features of building-unit SA I, Phase B: a) Hearth-plaster sample KVP13.9, deposit Type 8b; a pale brown silty clay loam plaster was used to shape the kerb of circular hearth Ft.42. 10% Silty clay orange aggregates characterise the groundmass; in the middle a longitudinal section of a siliceous spicule (200 µm), filled with ashes, PPL; b) Floor plaster sample KVP13.14, deposit Type 9c. The floor plaster is characterised by a pale brown, calcareous sandy clay loam. A 2mm sandy clay loam burnt aggregate, possibly as hearth-residue, is embedded in the plaster groundmass; its rounded shape possibly suggest that the aggregate was swept; PPL. c) Plaster coating, sample KVP13.5, deposit Type 8a. The silty clay lime plaster, characterised by 30% ceramic inclusions, was used to coat the internal surface of mortar Ft. 44; PPL. The difference in composition between this coating plaster and the floor plaster associated with the mortar installation, suggests that ceramic inclusions were deliberately added to the lime plaster to improve the mechanical strength of coating material and/or to bulk out the lime product.

6.4.3 Building-unit SA I, Early Phase B: Floors and occupation deposits.

Smashed body shards and other fragmentary ceramic objects were trampled on the plaster floor (Fig. 6.5 a). However, they may not be a reliable indicator of activities carried out during the life-history in this unit in the Earlier Phase B, as they may offer more clues about practices and discard at the end of the building occupation (La Motta and Schiffer 1999).

To clarify the phases of use and activities on surfaces of SA I, an undisturbed block for micromorphological analysis, Sample KVP14.5, was taken from Section 1(Fig. 6.7, b), in the north half of the interior building-unit. This section had been placed in the proximity of the double basins Ft. 43, to examine the two phases of occupation of the building-unit.

The earliest use of the building-unit is represented by 8-10 cm thick, pale brown, fine sandy clay loam plaster floor ([461], deposit Type 9c), which was possibly produced using fired lime (see Section 4.5.9; for analyses of plaster technology see Section 5.3.3) and laid on the foundation bedrock floor (Fig. 6.7 b,c).

Post-depositional bioturbation and secondary calcite formation resulted in a diffused, irregular boundary between this plaster floor of the early occupation phase and the overlying deposits, making impossible the identification of whether or not there were thin lenses of occupation (Fig. 6.7 d).

The end of the earlier occupation is marked by a 9cm thick dark, heterogeneous layer of organic, burnt material including ashes, disarticulated phytoliths and charred matter, mixed with sediment aggregates ([459], deposit Type 10b). The presence of 5% spherulites, residues of dung pellets, scattered amongst ashes (10%) and charred matter (>20%) may indicate discarded/raked-out material that include dung-fuel, possibly from the nearby circular hearth, which were re-distributed as ground-raising constructional material, and perhaps import of material, given the thickness of 9cm (Fig. 6.7 e, f; Shahack-Gross et al. 2005; Macphail and Goldberg 2010, 592-595). The upper part of the deposit [459 b] is also characterised by >10% of architectural materials debris, including lumps of plaster, and vitrified mud-bricks (Fig. 6.7 g), suggesting that inorganic materials were also mixed with the organic-rich layer, possibly to confer structural strength to the constructional packing, in preparation for the later phase of use, Phase A (Matthews et al. 1996; Milek 2012, 126).

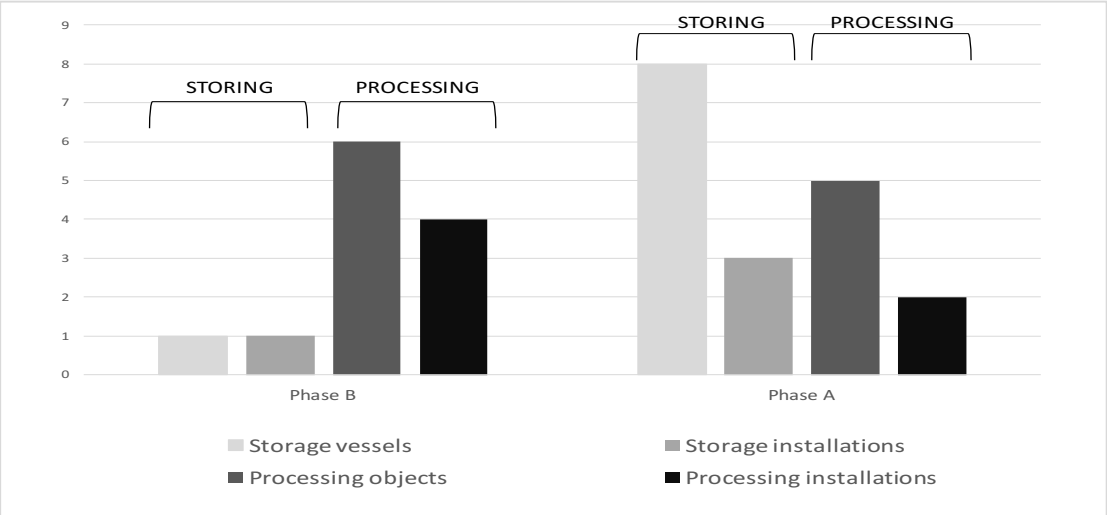


Figure 6.6 Bar Chart showing the variation in identified activities between Phase B and Phase A in SA I. Artefacts as vessels and stone objects and architectural installation as basins and emplacements are used in the graph as indicator of this variation. Just two of the activities analysed are considered in the graph as the ones that were more affected by temporal variation. The values recorded have been calculated by number. As illustrated in the graph, while in phase B there is a majority of tools and installations related to processing activity, in Phase A storage vessels and installations are more prevalent; this trend possibly suggests an improvement in production and socio-economic system, as discussed in Section 8.4.3.3.

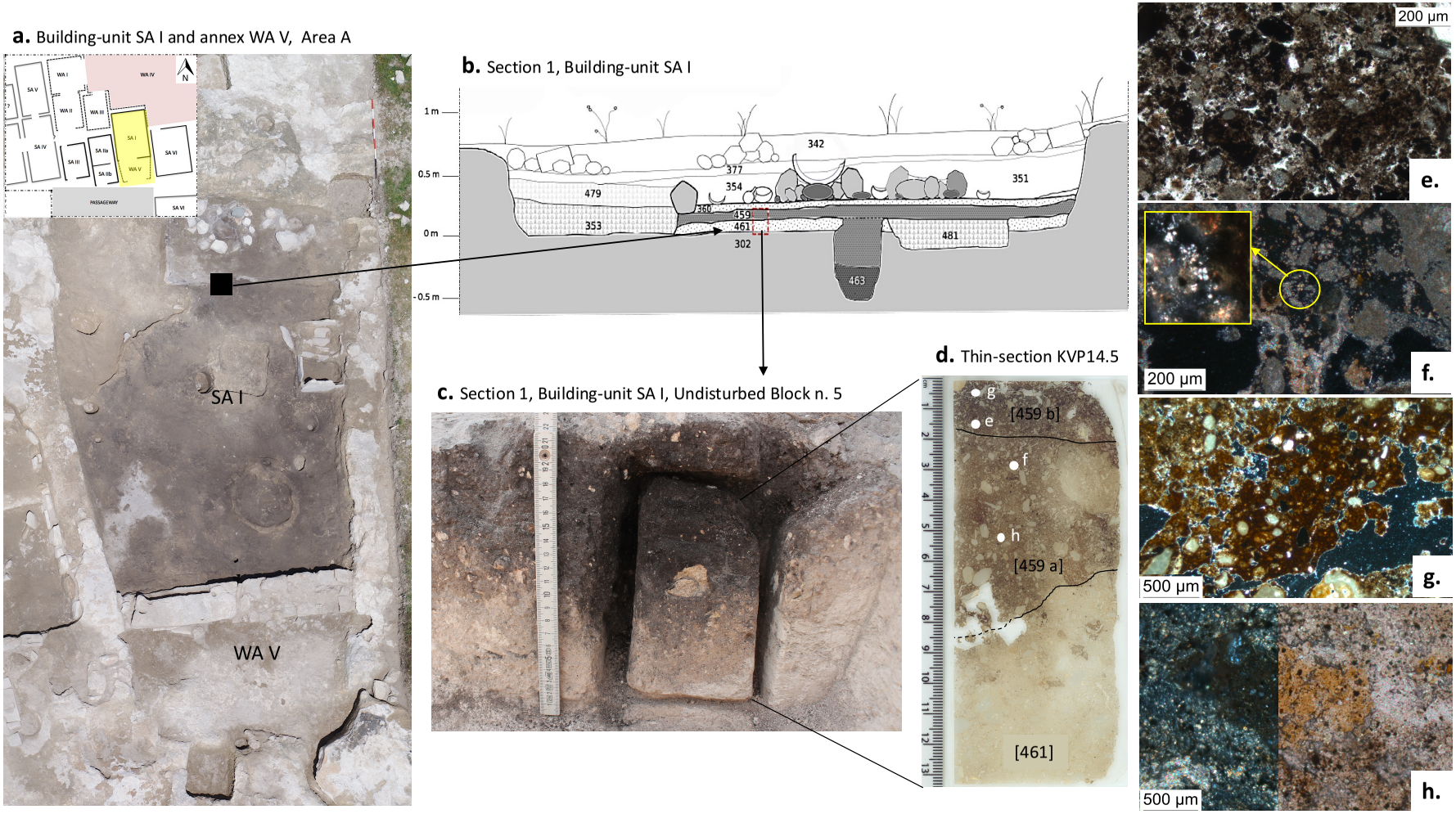


Figure 6.7 Microstratigraphy of floors in building-unit SA I. a) Aerial photo of building-unit SA I and annex WA V, with the placement of section 1 (black square) on the Norther side area. b) Section 1 with the sequences of floors and deposits, as analysed in the field. c) Picture of Section 1 with the undisturbed block n. 5; d) Thin section KVP14.5 represents the sequence of pale brown, sandy clay loam floor plaster of Phase B [461] (deposit Type 9c), overlaid by the heterogeneous, organic rich packing [459]. e-h) Photomicrographs of inclusions observed in units 459 a-b: e) Charred matter mixed with ashes and rare disarticulated phytoliths are distributed in the groundmass of unit 459a-b, XPL; f) 5-15 µm spherulites are scattered in unit 459a as relicts of dung pellets, XPL; g) vitrified architectural material in unit 459b, characterised by vesicular voids possibly created by expansion of trapped gases (Sean Quinn 2013), XPL; h) Phosphatic aggregate in unit 459a, as residue of organic waste (left in XPL, right in PPL).

6.4.4 Building-unit SA I, Late Phase A: Architectural installations and artefacts.

In the later phase of building-unit SA I the entrance was completely transformed with the introduction of a carefully dressed monolithic limestone threshold of 1.80 x 0.65 m (D.5), placed on the south-west side of a 70 cm thick wall (W.1) that was possibly re-constructed with more regular limestone blocks and slabs (Fig. 6.7). This monolithic threshold appears to mark the architectonic renovation of SA I, both aesthetically and ideologically (see Section 8.4.3.2; Bombardieri *et al*. 2012). The monolithic block (1, 65m long) was carved in order to have a step on its inner side and holes to allocate 5 cm posts, for door jambs. For its manufacture and its regular proportions this threshold may be considered an 'ashlar' prototype similar to many examples of LC structures, and different from threshold identified in many other EC-MC sites as Marki-*Alonia* (Frankel and Webb 2006, 11), Alambra-*Asproyi* (Gjerstad 1926, 22), Sotira-*Kaminoudhia* (Area C, Unit 25; Swiny *et al.* 2003, 40; 87, Fig. 2. 11) and Alambra-*Mouttes* (Building I, Rooms 7 and 3; Coleman *et al*. 1996, pl. 5c), which were constructed re-using limestone blocks and demolished walls and benches (Bombardieri *et al.* 2012). In addition to the aesthetic value, there is also an ideological implication, as doors are means to control space and are used to limit and filter passage from an open, public space to a roofed and more private one (Unwin 2007; Fisher 2007; 2009a). In this sense, the introduction of a stepped threshold and door improved the architectonic elaboration of SA I, marked the importance of this liminal area and enhanced the social representation of the building-unit (see Section 8.4.3.2).



Figure 6.7 Monolithic limestone threshold D. 5; building-unit SA I, Area A.

In the same period of construction and renovation, the interior unit SA I was subdivided in three sub-units by the introduction of a partition kerb in limestone blocks, in the northern section of the unit (W. 2).

Sub-unit 1, on the north-east side of the building (7 m^2; 3.5 x 2 m) was furnished with three fixed emplacements (Fts. 1-3), made of limestone blocks and diabase stones, associated with three semi-fixed big Red Polished Ware and Drab Polished Ware pithoi (<1 m high), one decorated spouted juglet, found within one of the pithoi, and six more portable RP bowls (diameter 8-12 cm). These vessels suggest with good probability that sub-unit 1 was arranged as storage space, and the associated bowls were used to transport and carry the product/products and/or to restock the big pithoi. The presence of a spouted juglet, found within one of the big pithoi, may imply that liquid products were stored in this vessel and that the juglet was used to draw and pour the liquid substance from/in the big storage pot. Preliminary chemical analysis of the ceramic bases of these storage vessels using Infrared and Raman spectroscopy did not produce any conclusive evidence about the possibly organic and/or dyeing products stored in SA I (Romiti 2015). Further investigation using Gas Chromatography-Mass Spectrometry will be systematically applied to analyse traces of contents in storage pots and basins from roofed and unroofed areas to possibly define a valid data-set to support the reconstruction of activities in the settlement and endorse wider and more precise archaeological interpretation (Charters at al. 1993; Eerkens 2005).

The north-western corner of the unit was truncated and filled with a yellow, loose calcareous sandy clay loam, to construct a small space of 4 m^2, 2 x 2 m –sub-unit 2. The absence of plaster may suggest the possible presence of a wooden plank or a rug or possibly indicate that the floor plaster may have dug out during truncation after the last occupation. In sub-unit 3, the largest of the three (27.5; 5 x 5.5 m), the circular plaster hearth of the earlier phase B, was replaced by a new rectangular, double chambered oven (Ft. 4), made of limestone slabs bound with sandy clay loam mortar (deposit Type 7b), which was moved to be against the eastern wall of SA I, possibly to facilitate movements and activities within the area. In the firing chamber a dark ashy sediment, rich in charred materials has been identified, associated with a modified Red Polished jug, extensively blackened, possibly used as prop to balance cooking pots, as also suggested by Frankel and Webb, for similar installations analysed at Marki-*Alonia* (Frankel and Webb 2006, 14).

Two fragmentary pithoi together with smaller pots as two DP jugs, 1 DP pyxis and 1 RP juglet may have been functional to storing and transporting products. The higher occurrence of storage

facilities, may suggest a possible increase in production and control over commodities during the late Phase A, as discussed in Section 6.4.8 and more widely in Section 8.4.3.2. A modified spouted basin with a hole at the centre of its base (18 mm) and a cooking pot have been identified on the floor nearby the rectangular hearth, possibly pertaining to baking/heating up activities. Differences in surface colour between mended sherds on the pot body suggest that the vessel broke into several parts during or after it final use and that these fragments were subject to post-depositional conditions, apparently involving some exposure to fire (Webb 2017). In the southern portion of the area several fragments of chert and two diabase grinders, one picrolite pointed tool, one spindle whorls and a limestone weight suggest that a number of different activities involving the processing of inorganic and organic materials were carried out. The absence of materials in the western section of the area, instead, may imply that this space was possibly used a passage-way, in correspondence to the doorway.

The material assemblage found in unit SAI, even if offered good clues to reconstruct past activities carried out in the building, has to be considered a selected group of objects, which was intentionally left behind when the community decide to move away (‘*de facto’* refuse, La Motta and Schiffer 1999). Therefore, the assemblage is just partially representative of the original inventory in use during the later phase A, in SA I.

6.4.5 Building-unit SA I, Late Phase A: Floors and occupation deposits.

The later use of this building-unit is represented by the initial placement of a 5 cm thick floor plaster, as analysed in the field. The lack of undisturbed samples for micromorphological analysis limited the possibility to analyse the use and impact of activities on the floor plaster of the Later Phase A. A small block was collected during the fieldwork season 2013, and the relative thin-section KVP13.15 has been analysed, in order to study composition of this floor plaster.

The *pale brown, fine sand clay loam, floor plaster ([360], F.3, deposit Type 9c), shows micromorphological characteristics similar to the floor plaster of the earlier phase B. It is interesting to note that this specific floor plaster sub-type (Deposit Type 9c) occurs in roofed working areas, where multifunctional activities were carried out, as also illustrated by the cladistics diagram Fig 6.26.*

6.4.6 Annex WA V. Features and artefacts, floors and occupation deposits.

The small annex WA V was placed on the southern side of building unit-SA I. It was originally carved at an inferior depth into the bedrock floor (25-30 cm approximately) in a roughly rectangular shape. The early occupation of this unit is marked by the construction of

architectural installations carved into the bedrock floor as a squared (Ft.37; dimension: 80 x 80 cm;) and circular basin (Ft. 38; diameter: 25 cm, depth: 20 cm), lined with a pale brown, sandy clay loam plaster, and a deep curvilinear channel (Ft. 39; depth: 30 cm), possibly used as water discharge.

The lack of prepared floors in the small unit WA V suggests that it possibly was an open working space during the earlier occupation Phase B; this interpretation is also supported by the presence of basins and channels carved into the bedrock floor, as also observed in open and semi-open areas of Area A.

In the latest Phase A, WA V was enclosed with the introduction of a limitation structure on the southern side of the structure. The open working space was turned into a roofed unit of 12 m^2, which was organized in order to be in direct communication with the outdoor space. The working installations in use during the earlier Phase B, as basins and channel, were infilled with calcareous, yellow sandy clay loam, from discarded inorganic materials, and were completely covered by the construction of a 2 cm thick layer of pale brown calcareous sandy clay loam plaster [393]. This evidence presumably suggests there was a change in the use of space from working to cleaner activities. This data together with the evidence from architectural and syntactic analysis, indicate that WA V was used as reception/entrance space of the main building SA I. The role and function of this entranceway was possibly to extend the liminal boundary role of the monolithic threshold of SA I over a longer distance and thereby increase the consciousness of the transition for who moved through it, as suggested by Fisher (2009a) in the analysis of Ashlar Building of Enkomi (see Section 8.4.3.1).

6.4.7 Building-unit SA I: Abandonment process

In building-unit SA I the occupation surface of the late phase A was sealed by destruction deposits from the collapse of building-structures. The lack of deposits accumulated between the floor plaster of phase A and the destruction layers, excluded the possibility of a second use of the structure after the abandonment, and confirmed the hypothesis of a fast burial of underlying deposits (Friesem *et al*. 2014a). This idea is also confirmed by the good preservation of installations and artefacts preserved on the occupation floor.

Phase A floor plaster was overlain by a layer of yellow-orange sandy clay loam, possibly pertaining to the destruction of mud-brick walls. Within this deposit many intact mudbricks as well as earthen material from roofing structures have been found [353, 354]. Lenses of burnt, ash-rich layers, associated with charred flecks [351, 362], possibly related to the burning of wooden structures, are mixed with walls destruction deposits. Three extensive lenses of burnt sediment were identified in the interior space of SA I and may possibly pertain to ignition points

(Harrison 2008): one along the southern wall, where the entrance is located; one at the centre of the building-unit; the last one, on the north-east side, where the emplacements were placed (sub-unit 1).

The idea of a possible firing event is supported by micromorphological evidence. The analysis of mud-brick KVP13.2, earthen wall plasters KVP14.30, KVP14.33 as well as roofing material KVP14.29 showed the occurrence of alterations by fire, as discolouration, reddening and vitrification on all the materials pertaining to the collapse of the western and southern walls (see Section 4.2). The occurrence of post depositional fire alterations is also confirmed by spectroscopic analysis conducted on these materials, whose results showed anomalies in clay peaks, identified as possible results of exposure to elevated temperatures (Section 5.4).

The hardening and blackening of underlying plaster floor may represent a further evidence to confirm the hypothesis of fire event (Harrison 2004; 2008).

Whether the fire was accidental or deliberate is difficult to confirm. However, both the diffused traces of burning on the inner area of SA I, and the fact that structures made of stones and mudbricks are more difficult to ignite without any additional fuel, may exclude the possibility of an unintentional fire (Twiss *et al*. 2008; Harrison 2008), although roofing and other furnishing may have caught alight. The hypothesis of a possible arson is also sustained by the occurrence of traces of firing in other building-units of Area A, as in SA II and mainly in SA III, where this practice is supposed to be possibly linked to abandonment rituals (see Section 6.6.5).

6.4.8 Conclusion and interpretation

The evidence analysed in these sections showed how the space of building-unit SA I was significantly renovated and transformed between the earlier and the later use of the building. The architectural elaboration of SA I and WA V in the latest phase A, marked by the construction of a thick wall in the southern limit of the building (W1) and design and placement of a carved stone 'ashlar' threshold was accompanied with an enhancement in storage function as illustrated in Fig. 6.6, and with the change in activity and function of WA V. These elements may be interpreted as evidence of increasing wealth, privacy, security and social definition and control of access and ownership, specialisation and representation, and may possibly testify an improved system of production and a development in the socio-economic organisation at Erimi-LtP community, discussed in its wider context in Chapter 8.

Despite these innovations, some of the primary functions of this building-unit were not modified. SA I was designed as a building with a hearth/oven from the early phase of

occupation, through to the later phase A. This prerogative was maintained and materialised by the construction of a more durable oven made of limestone in Phase A (Fig. 6.8), concomitant with other materials aspects of increased elaboration of place, discussed further in Chapter 8.

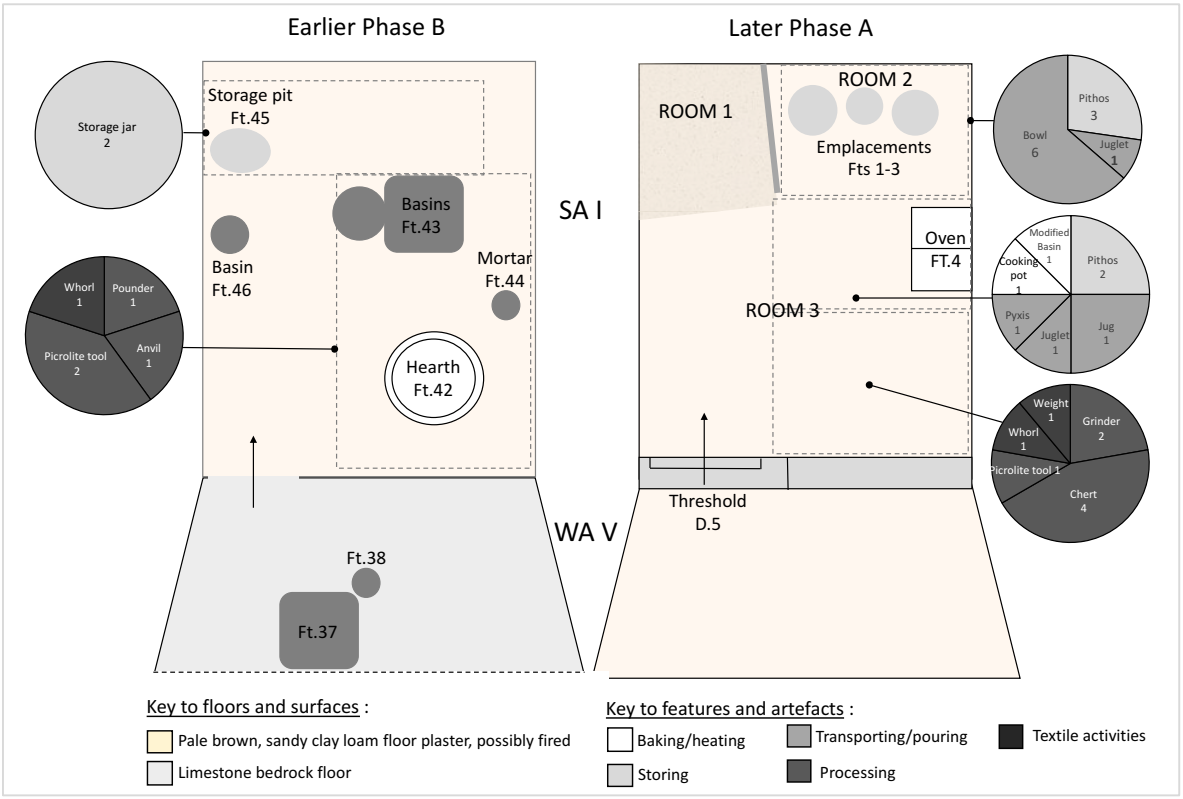


Figure 6.8 Variation in spatial organisation in unit SA I and annex WA V between the earlier Phase B and the later Phase A. The pie chart show the distribution and occurrence of artefacts according to functions they are related to.

6.5 Area A. Building-unit SA IIa and annex SA IIb: spatial layout and construction.

Building-unit SA II was placed in the southern section of Area A, adjacent to building-unit SA I on the East and to building-unit SA III on the West. The building was carved 60-65 cm deep into the limestone bedrock and it was designed with the long axis oriented North-south, as well as the other building-units and semi-open spaces of the settlement. Building-unit SA II was constructed in order to be organised with a main rectangular unit on the northern side, SA IIa, of 22.11 m^2 (6.7 x 3.3 m), and a small, squared annex on the southern side, SA IIb, of 6 m^2 (2 x 3 m), which functioned as entrance room, and that possibly was used to filter the access of people within the inner SA IIa, similarly to annex WA V.

The doorway of building-unit SA IIa was placed on its southern side in order to connect this unit to the annex, SA IIb. This small annex was accessible to exterior space through a doorway on its southern side. However, the architectonical transformations, implemented between the

two documented occupation phases, slightly modified the accesses placement and consequently the internal routes within this building, as described in Sections 6.5.2 and 6.5.5.

The two occupation phases identified in building-units SA IIa and SA IIb, and their related installations, artefacts, floors and occupation deposits are summarised in Tables 6.8 and 6.9.

Table 6.8 Stratigraphic sequence of deposits analysed in building-unit SA IIa. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Macro and micro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	*Orange/brown, silty clay loam mixed to grey ashes [423]; Dark brown, sandy clay loam mixed to burnt debris ([448, 422, 427, 434], Type 12a)*
Use - Phase A	- Processing	Fixed elements: Bench in limestone blocks and pale brown sandy clay loam plaster (Ft. 11) Semi-fixed elements: 2 dolerite querns, one of which is associated with a rubber stone; Portable objects: 1 cooking pot 1 Coarse ware milling bin 2 RP small bowls 1 RP basin
	- Utilitarian/ritual	Portable objects: Fragmentary bronze blade associated with RP basin
	- Storing activity	Fixed elements**:** Emplacement in limestone blocks (Ft. 56) Emplacement in limestone blocks (Ft. 64) Semi-fixed elements**:** 1 RP pithos associated with emplacement FT. 56 3 DP amphorae (one decorated) 1 RP storage jar
	-Transporting	Portable objects**:** 1 RP jug (decorated) 2 DP spouted jugs 1 DP modified juglet
Construction - Phase A	- Walls	Partition wall (W3)
	- Doorway	Pivot stone (D.13)
	- Floor	*White silty clay **floor** plaster (KVP13.10 [532], F.3, Type 9a)*
	- Infilling	Yellow, calcareous sandy clay loam infilling of mortar Ft. 62 [527, 521]
	- Packing	Brown, sandy clay loam mixed with architectural debris [448]
Use – Phase B	- Processing	Fixed elements: Circular mortar carved into the bedrock and plaster floor and coated with *silty clay plaster* (Type 3a) (Ft. 62). Bench shaped into the bedrock floor (Ft. 61) Semi-fixed element: Dolerite quern Portable objects: Dolerite pounder associated with mortar Ft. 62
Construction- Phase B	- Walls	Orthostats Ft 12 *Yellow-fine sandy clay loam bricks (Type 2b), KVP13.4, KVP13.172*
	- Doorway	60 cm doorway, cut at the centre of the southern limestone foundation base.
	- Floor	*Pale brown, fine sandy clay loam **floor plaster*** (KVP13.12 [530], F.7, Type 9c)
Foundation bedrock floor [302]		

Table 6.9 Stratigraphic sequence of deposits analysed in building-unit SA IIb. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Macro and micro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	Orange, silty clay loam and mudbricks debris ([421], Type 12b); Brown, calcareous sandy clay loam mixed to burn debris ([419], Type 12a); dark grey, silty clay ashes mixed with charred matter [420].
Use - Phase A	-Storing activity	Fixed elements: Rectangular bin made of limestone slabs and silty clay mortar Semi-fixed elements: 3 storage jars 2 amphorae (1 DP, 1 RP)
	-Transporting	Portable objects**:** 1 RP jug
	- Textile activities	Portable objects: 6 spindle whorls (1 decorated) 1 loom weight
	- Prestige/ritual	Portable objects: 1 askoid juglet 1 imported DP juglet 1 picrolite comb pendant
Construction - Phase A	- Walls	Limit wall (W4)
	- Structure	Red, sandy clay loam constructional material with post impressions; possible roofing structures.
	- Doorway	Monolithic threshold (D.10)
	- Floor	White silty clay **floor plaster** (KVP13.21 [444], F.16, Type 9a)
	- Packing	Pale brown, fine sand clay loam sediment [429].
Use – Phase B	- *Processing*	Fixed-elements: Circular mortar carved into the bedrock and plaster floor and coated with *silty clay plaster* (Type 3a) (Fts. 6, 7).
Construction – Phase B	- *Floor*	*Buff, silty clay loam **Plaster floor** (KVP13.11[435], F.6, Type 9b)*
Foundation bedrock floor [302]		

6.5.1 Walls construction and materials

The wall building technique adopted in unit SA IIa and IIb is similar to that of other buildings of the settlement, investigated to date. The possibility to identify different techniques in future field analysis, would shed light on possible early/later phase of occupation and diverse socio-cultural practices and choices at Erimi-LtP.

In contrast to other building-unit analysed, the eastern wall of SA IIa was furnished with a line of orthostats (Ft.12) that are dressed limestone blocks, vertically placed, thus to abut the foundation base of the wall structure as illustrated in Figure 6.9; these blocks were affixed to the limestone base with a 1 cm thick layer of earthen plaster.

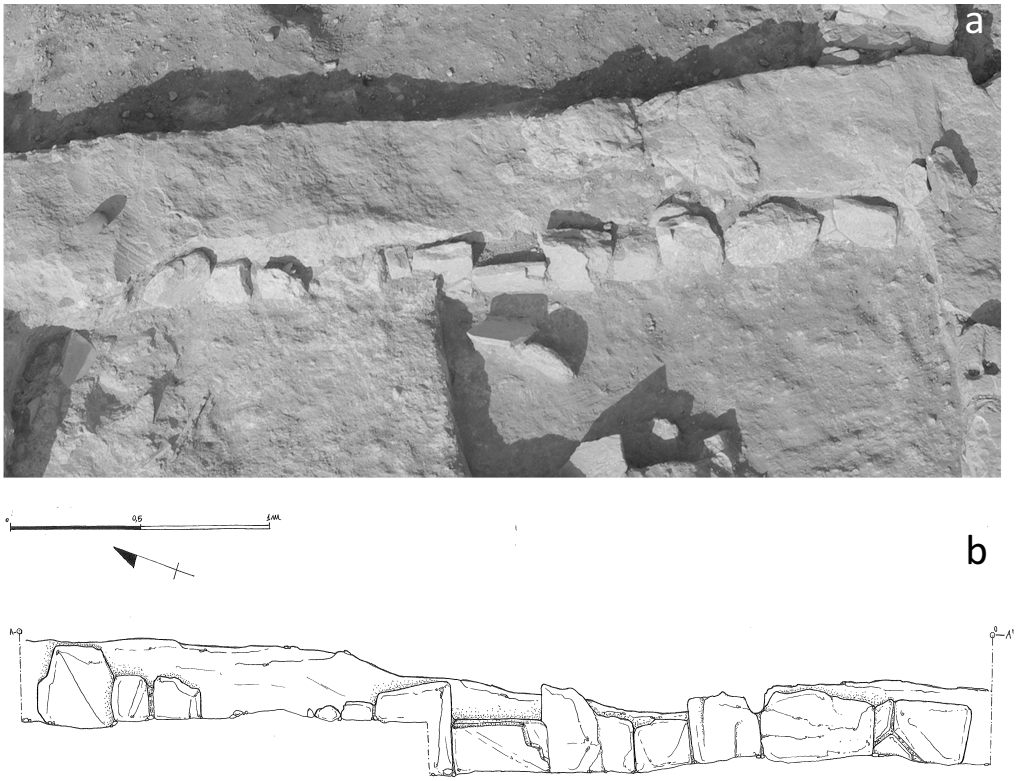


Figure 6.9 Orthostats, a) Internal unit SA IIa with the orthostat blocks flanking the eastern foundation base; the blocks were affixed at the bedrock base with a layer of earthen plaster; b) Front view drawing of the dressed limestone blocks; from Bombardieri, Amadio, Faggi 2015, 122-124).

The function of these orthostats was presumably to create a wider base on which to set a thicker load bearing wall (>60 cm), and to reinforce the building structure of SA IIa. As well as the monolithic threshold described earlier in unit SA I, the functions of these structures might have been practical and aesthetical at the same time, in an attempt to regularise the architectonic aspect of the limestone blocks, and to make these othostats an 'ashlar' prototype (Bombardieri *et al.* 2015; Philokyprou 2011, 48). Even if the use of irregular orthostats in the interior buildings is already documented at the Sotira-*Kaminoudhia* (Swiny 2008, 49; Swiny *et al.* 2003) during the earlier Philia phase (2500-2300 BC), the earliest evidence of regular (isodomic) ashlar masonries is commonly related to funerary architecture at Enkomi, and it appears in LC IIC (Kalavassos-*Ayios Dhimitrios*, Maroni-*Vournes*) and later in LC IIIA settlement contexts at Enkomi and Kition (Bombardieri *et al.* 2015). Therefore, it is likely that the roughly regular orthostats in SA IIa were introduced to support the eastern wall structure, but also to enhance the architectonic elaboration of the interior space of this building-unit (Bombardieri *et al.* 2015).

The upper parts of SA IIa wall structures were constructed using mud-bricks, as documented in the destruction deposits examined, where intact mud-bricks were preserved within the collapsed wall structures.

Micromorphological and XRF analyses of two mud-bricks samples, KVP13.4 and KVP13.172, recovered from the eastern and western walls of SA IIa and natural sediments collected in the settlement area, indicated that a yellow sandy clay loam, of calcareous origin (deposit Type 2b) was the used for bricks manufacture. Variations in the use of different local sources were not observed in the brick samples analysed; however, it is important to consider that the number of samples recovered from collapsed structure in SA IIa was limited.

6.5.2 Building-unit SA IIa, early Phase B: Architectural installations and artefacts

In the early Phase B the internal space of unit SA IIa was characterised by the construction of a plastered circular mortar (Ft. 62, diameter 40 cm; depth 24.5 cm), placed in the south-middle section of the unit, carved into the bedrock floor and coated with a thick layer of fired lime plaster. The size, shape and composition of this installation and its association with a dolerite pounder left at its bottom, make this feature similar to the mortar identified in unit SA I. The yellow, silty clay loam deposit [526], which filled the lower section of this installation, did not produce any evidence about organic/inorganic materials processed in it. Analyses of bioarchaeological residues, which were recovered through flotation, identified modern materials, particularly seeds, which were transported from upper levels and redeposited in the lower levels by micro and meso fauna, accordingly with the interpretation of archaeobotanists (E. Vassio pers. comm.).

A bench carved from the bedrock (Ft.61), on the South-Western corner of the room nearby the mortar, suggests that the southern section of SA IIa was possibly related to processing activities, as further confirmed by the association with a big dolerite quern (dimensions: 52.5 cm x 31 cm), found nearby the bench, but possibly not *in situ*.

Differently the absence of architectural installations and artefacts in the north section of the building-unit may suggest that activities, possibly performed with portable tools, as spindle whorls or stone objects of small-medium size were possibly carried out.

6.5.3 Building-unit SA IIa, early Phase B: Floors and occupation deposits.

The analysis of floors and occupation deposits of both units SA IIa and SA IIb are only based on field description and macroscopic analysis of the stratigraphic sequences of floors and accumulated deposits as these units were already excavated when the micromorphological analyses were firstly applied on the site area. Undisturbed blocks for micromorphology analysis were collected from two plinths left on the eastern and western sides of the inner unit SA IIa, and are representative of abandonment sequences with embedded collapsed architectural materials, which are therefore discussed later in Section 6.5.8.

Nevertheless, microscopic analysis was carried out of selected smaller block samples of floors, during the fieldwork campaigns 2011 and 2013. Although this precluded the identification of possible microscopic accumulations of subsequent occupation deposits on the floors surfaces and the analysis of boundaries between the floors and overlying deposits, micromorphological analysis of these samples permitted to analyse the composition of floors, including their particles size, colour, and presence of aggregates and their manufacture, in relation to specific use and variation in the use of space, as illustrated in the cladistic diagram, Figure 6.26.

Field analysis indicates that the earlier occupation of building-unit SA IIa is represented by 5cm thick floor plaster ([530], F.7), as illustrated by section 2, on the long, eastern side of the building-unit (Fig. 6.12 b). *Micromorphological analysis on small floor plaster sample KVP13.12 revealed that this floor was manufactured using fired lime (see FTIR results, Section 5.3.3), mixed to brow, sandy clay loam sediment, from soil horizon B/C (deposit Type 9c).*

The end of the early occupation is marked by a 7-8 cm thick layer of architectural debris, including small size limestone blocks, mixed with a brown, calcareous sandy clay loam [448], possibly used as constructional packing to rise up the level of room.

6.5.4 Building-unit SA IIa, late Phase A: Architectural installations and artefacts

Additional architectonic and artefactual evidence support the interpretation of the use of space of SA IIa during the later Phase A.

A 50cm thick partition wall in irregular limestone blocks and earthen plaster (W3) was built on the southern side of the unit SA IIa, to close the access of the previous phase. The new doorway, was placed on the south-east side of the building-unit, and it is represented by a dressed stone block with circular and linear settings, which possibly functioned as pivot stone. The placement of the doorway on the South-East corner of the building, is in contrast to the general layout observed in other building-units of Area A, as SA I and SA III, where the accesses were placed on the South-Western side of the structures. This choice was possibly done to deliberately modify the internal passage from the small annex SA IIb to the main building SA IIa, and thereby to make the access to the main building less direct. This idea appears to be confirmed by the introduction of a monolithic threshold on the South-Western corner of annex SA IIb. This doorways layout forced people to move from the outdoor space to building SA IIa following a curved route (Fig. 6.10).

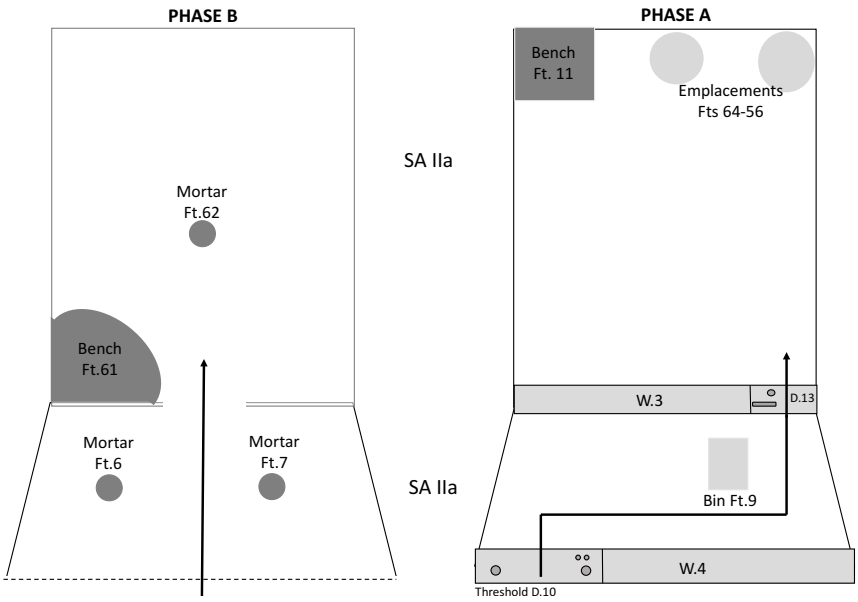


Figure 6.10 Routes between annex SA IIb and main-building SA IIa in Phase B and Phase A. The black arrows indicate the internal movement to reach building-Unit SA IIa from the outdoor space.

The horizontal spatial variation in activity areas is less evident in this building, than in building-unit SA I. In fact, no partition element nor variation in distribution of artefacts and installations were observed in this building-unit. However, temporal variations in the distribution of activities between the early Phase B and the late Phase A are visible in the different arrangement of installations and artefacts. While working installations in Phase B were placed on the south section of the room, in Phase A these working features were moved on the northern side of the unit, possibly in relation with different routes within the building-unit (Fig. 6.10).

Fixed and semi-fixed elements identified within the building-unit represent sensible indicators of activities carried out in this space in the later Phase A. A bench in limestone blocks and sandy clay loam plaster (Ft. 11), was placed at the bottom of the building-unit, on the north-western corner, associated with a dolerite quern and a fragmentary rubber stone. On north-eastern side, two emplacements in limestone blocks and basal river stones were also set (Fts. 56-64). The easternmost was possibly related with a big RP pithos (80 cm high, approximately), recovered on the Phase A floor, broken in two parts (Fig. 6.11).

The ceramic assemblage recovered in the norther section includes mainly semi-fixed vessels as a RP storage jar, a RP decorated big jug, two DP amphorae, which were related to storage activities, associated with two portable objects as DP spouted jug and juglet, which were functional to the use of liquids products.

The distribution of installations and artefacts suggest that the building-unit SA IIa was predominantly designed to process and store activities, with a distinction between the North-

Western side of the unit, arranged as grinding-station, and the north/north-east side organised as storage space of products, possibly resulting from the grinding activities conducted in this space.

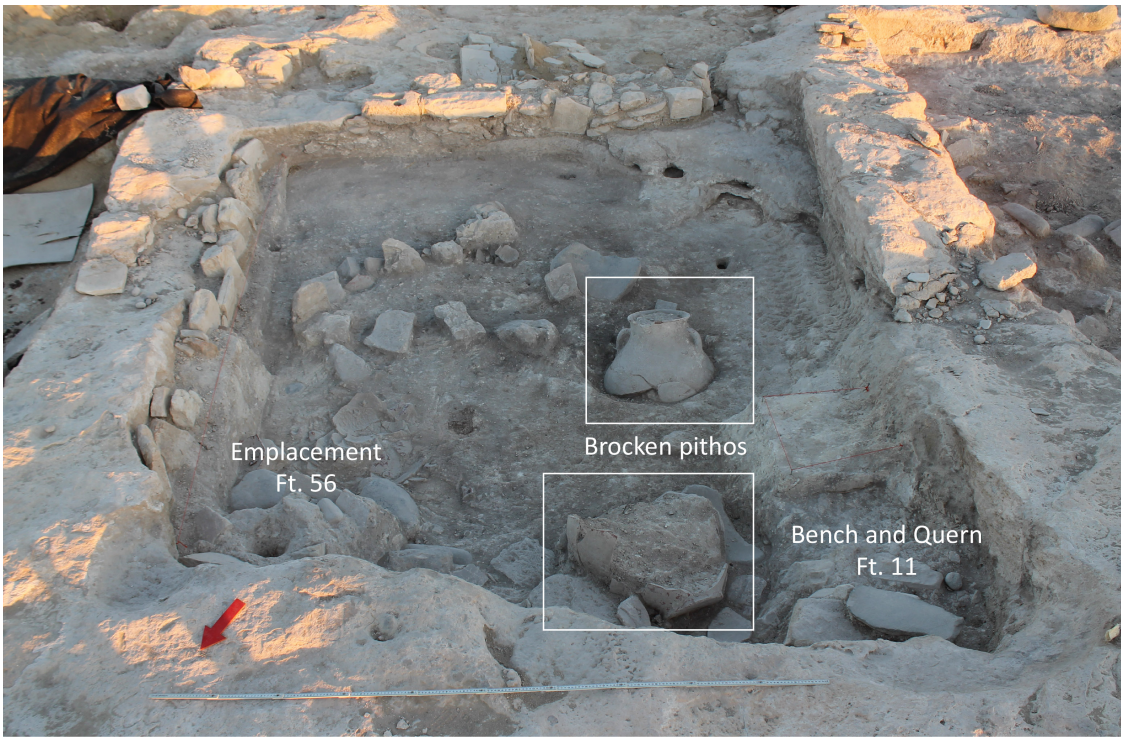


Figure 6.11 Building-unit SA IIa with indication of fixed and semi-fixed elements pertaining to the later Phase A.

In the southern section, nearby the entrance, a series of portable objects, among which one cooking pot and one fragmentary mealing bin in Coarse Ware, two RP small bowls and a RP basin with a fragmentary bronze blade preserved in it, suggest a possible association with cooking/processing activities. The bronze tool recovered represents a unique object among the artefact found in the settlement to date, as bronze objects are more frequently attested in funerary contests at Erimi-LtP. The fact that the settlement of Erimi-Ltp was distant from copper ores may explain the limited diffusion of metal objects in the settlement, but also stresses the significance of this metal artefacts, as working tool that possibly also incorporated symbolic and ritual aspects (Hastorf 2001; Parker Pearson and Richards 1994, 6). For this reason, its occurrence within the materials left behind when the settlement was abandoned, may be representative not only of daily activities, but also of possible ritual practices and symbolic roles embedded in this built-space.

Other materials as a DP decorated spouted jug, and a DP decorated amphora were also identified in the southern area closed to entrance, possibly functional to storing processed products.

6.5.5 Building-unit SA IIa, late Phase A: Floors and occupation deposits

The later Phase A of unit SA IIa is marked by the construction of a 3cm thick layer of white, silty clay floor plaster *([532], F. 3)*, as analysed in the field. *Micromorphological analysis conducted on small floor plaster sample KVP13.10 coupled with XRF analysis on local natural sediments suggest that the silty clay floor plaster, deposit Type 9a, was manufactured using local havara deposit. The compact microstructure of this plaster-type and the presence of altered bioclasts, as residual material of fired limestone, suggest that this plaster was possibly produced with fired lime, even if spectroscopic analysis did not provide any definitive result (see Section 5.3.3; Chu et al. 2008, Regev et al. 2010). The addition of organic additives, including dung, seems to be testified by the presence of calcium oxalates and spherulites; this choice was possibly made to produce a more malleable and cohesive material that could be applied in layers. The introduction of a fine, possibly fired floor plaster type may represent an aesthetic improvement within the building-unit, as white floors may have functional as well as symbolic attributed related with hygiene, cleanliness and purity (Matthews 2005; Clarke 2012) and may indicate an elevated specialisation in the manufacture of this product, possibly resulting from a redistribution of workforce and specialisation of labour, as consequence of an increase in community wealth, as more widely discussed in Chapter 8.*

6.5.6 Annex SA IIb, early Phase B: features and artefacts, floors and occupation deposits.

Annex SA IIb was carved at an inferior depth into the bedrock floor (30 cm approximately) in a roughly rectangular shape, and it was organised as semi-open space, as indicated by the absence of limitation structures on the southern side of the structure during the early Phase B.

The architectural and artefactual evidence analysed in this small space indicate pronounced temporal variations in the occupation sequence, and a transformation in use of space between the early Phase B and the subsequent Phase A, more marked than that observed in the main-building SA IIa.

Two circular mortars (Ft. 6 diameter: 34 cm, depth: 23.5; Ft.7 diameter 36 cm, depth: 24 cm) were carved in the bedrock floor and coated with lime plaster, similarly to that observed in building-unit SA IIa and SA I-Phase B. These fixed installations were placed on the eastern and western section of this small unit in order to not obstruct the access to SA IIa. The total absence of objects pertaining to this early phase may be representative of particular uses and maintenance practice possibly resulting from a continuity of occupation of this space.

In the early Phase B, a 2cm thick layer of floor plaster ([435], F. 6) was laid on the foundation bedrock floor of annex SA IIb. *The buff, silty clay loam floor plaster KVP13.11 (deposit Type*

9b) was produced with local havara mixed with heterogeneous inclusions, both of inorganic origin as fine sand-silty size calcareous rocks and orange silty clay sediment aggregates, and organic origin as charred flecks, and spherulites, that are likely to have improved the mechanical strength of this material. The use of an unfired floor plaster in annex SA IIb, which differs from the fired lime floor plaster laid on the main building SA IIa, may represent and reflect different use and function of this space and possibly support the idea of SA IIb as semi-open space during the early occupation phase B.

6.5.7 Annex SA IIb, late Phase A: features and artefacts, floors and occupation deposits.

During the late Phase A, this unit was renovated with the construction of a 60cm thick south limit wall (W 4) that was furnished with a monolithic threshold (D10), similar to threshold D.5 in SA I, but smaller in size (1.10 x 0.40). A new access of 60 cm was created, and the internal passage between SA IIb and SA IIa was modified, as illustrated in Figure 6.10.

The semi-open space was turned into a closed building-unit of 5 m^2. This new spatial layout enhanced the segregation of building SA IIa, marking the separation between the outdoor space and the main building SA IIa. The syntactic characteristics of this small annex suggest that SA IIb functioned as a proper hallway, which canalised and possibly filtered the flow of people moving within SA IIa (see Fig. 6.3 and Table 6.2). At the same time the introduction of monolithic threshold, enhanced the role and function of this entranceway, as also suggested by the artefactual assemblage recovered within it.

A bin made of limestone slabs was built on the eastern side of this small unit (Ft. 9), over one of the circular mortar in use during the early phase B. This installation may possibly have provided short-term storage for more immediate needs (Frankel and Webb 2012, 489). A high number of semi-fixed vessels and portable objects, which may be associated to different activities, was packed over the floor of this small unit during the late Phase A. The assemblage includes three fragmentary storage jars, two amphorae (one of them decorated) and a RP jug placed on the western side of the small unit, closed to the entrance. The occurrence of six spindle whorls, one of them decorated, and a loom weight, scattered on the north-west side of the unit, attest the relationship of SA IIb with textile activities. Just two pots were identified and recovered from the eastern side of SA IIb: an askoid juglet (a small pouring vessel with zoomorphic traits; Webb 2017), and a DP juglet with incised decorations, imported from the western area of Cyprus (Webb 2017). As well as the bronze blade found in SA IIa, these two juglets were more than common-use objects and possibly they might have embedded with symbolic values (Hastorf 2001).

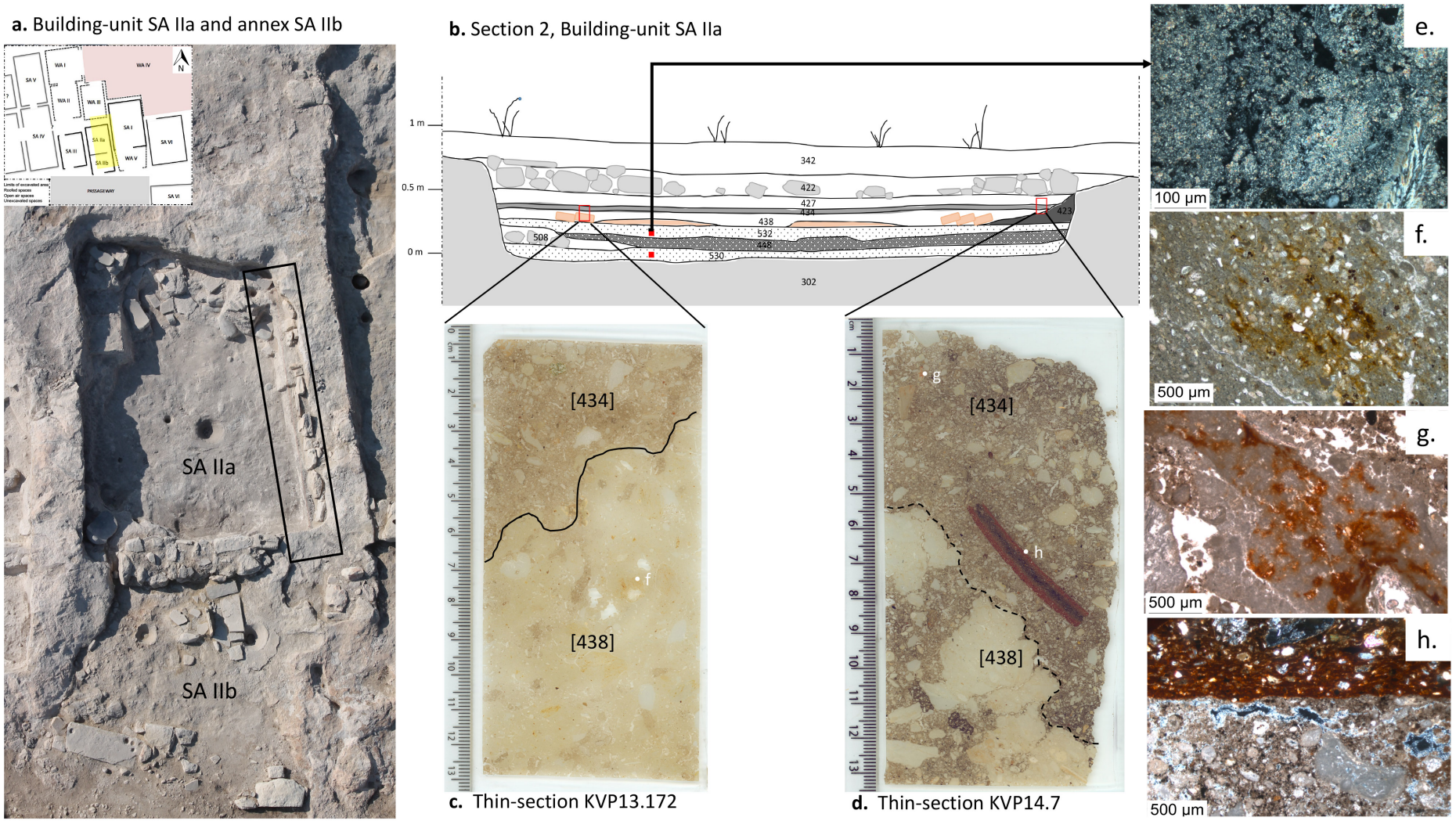


Figure 6.12 Microstratigraphy of floors and destruction deposits in building-unit SA IIa a) Aerial photo of building-unit SA IIa and annex SA IIb, with the placement of section 2 (black rectangle) on the Eastern side. b) Section 2 with the sequences of floors and destruction deposits, as analysed in the field. In red the placement of undisturbed blocks and small floor samples. c) Thin section KVP13.172 represents the destruction sequence of yellow sandy clay loam degraded mudbricks [438] (deposit Type 2b), overlaid by brown sandy clay loam deposit [434] (Type 12a) of collapsed building materials mixed to charred particles. d) Thin section KVP14. 7 represent the brown sandy clay loam destruction deposit[434] (Type 12a) characterised by collapsed building materials and pottery sherd (at the centre). e) Photomicrographs of floor plaster sample KVP13.10 pertaining to the late phase A, characterised by > 10% spherulites as residues of dung temper. At the right bottom corner an altered bioclast may possibly suggest that the plaster was produced with fired lime, XPL f) Photomicrograph showing traces of decolouration and oxidation in yellow sandy clay loam degraded mudbricks, unit 438, Type 2b; KVP13.172, PPL. g) Altered limestone inclusion in brown sandy clay loam destruction deposit 434, Type 12a; KVP14.7, PPL h) Photomicrograph showing vitrified edge of pottery inclusion in brown sandy clay loam destruction deposits [434] Type 12a; KVP14.7; XPL

The duality between utility and symbolism is further confirmed by the occurrence of another artefact, which was found in the proximity of the threshold: a picrolite comb-shaped pendant (Fig. 6.13), which according to Bombardieri it is not only an aesthetic or simply functional object but it may symbolise the community identity and status (Bombardieri 2017; Steel 2004).



Figure 6.13 Monolithic limestone threshold D10 of building-unit SA IIb, with the placement of picrolite comb pendant.

The ambivalence of these artefact makes the interpretation about activities and uses of this building-unit more difficult. On the basis of stratigraphic and archaeological evidence analysed it is not possible to confirm if the numerous materials left of the floor of this space may reflect the last use and occupation of the building, or, instead, may be significant of ritual practices, possible connected with abandonment ceremonies.

A 0.3 cm thin floor plaster ([444], F. 16;) was laid on a 2 cm thick, pale brown, sand clay loam packing of inorganic material [429] as analysed in the field. *Micromorphological analysis on the small sample KVP13.21, deposit Type 9a, revealed that a white silty clay floor plaster was laid on the small building-unit. The plaster floor, was possibly manufactured simply crushing the local havara and mixing the obtained powdered calcite with water. This suggestion may be confirmed by the occurrence of 20% siliceous sponge spicule that were not altered by exposure to fire, and further verified by FTIR analysis, which do not show alteration in the ratio between the main calcite peaks (see Section 5.3.3). The introduction of a fine, white floor plaster, marks*

the change in use of this building-unit from dirtier-working activities to cleaner-possibly representative activities.

6.5.8 Building-unit SA IIa and annex SA IIb: Abandonment process

The abandonment phase of unit SA IIa is characterised by a destruction layer of > 30 cm which includes different deposits. On the last occupation floor plaster, a 3-5 cm layer of yellow-pale brown, calcareous sandy clay loam, possibly pertaining to the collapse of wall plaster coating, and an orange, brown silty clay loam patches of possible disaggregated mudbricks (unit 438) were observed. These deposits are overlain by a >10 cm layer of a brown, burnt sandy clay loam, unit 434, mainly deposited on the on the eastern and south-eastern section of the building-unit, close to the access of the late Phase A. This burnt deposit is mixed to charred matter and building material debris, possibly pertaining to the collapse of walls and roofing structures. An upper layer, of >15 cm thick, of stones and limestone blocks, from the collapsed south and western wall bases, sealed completely the underlying destruction deposits.

Two micromorphology blocks have been collected from the north-east and south-east sections of building-unit SA IIa to analyse the depositional sequence related with the destruction and abandonment of this space.

Thin-section KVP13.172, from the north-eastern side of SA IIa, shows part of the destruction sequence, that comprises the collapse of mud-bricks presumably from the northern wall, and the overlying accumulation of brown sandy clay loam and building material debris, possibly pertaining to the collapse of roofing structures. The calcareous sandy clay loam deposit of yellow mud-bricks (unit 438, deposit Type 2b) shows traces of decolouration and oxidation (Fig.6.12 f), possibly for the spalling effect produced by the exposure to fire (Redsicker and O'Connor 2008). The unit shows some reworking especially in the proximity of the sharp irregular boundary, where strong turbation, possibly from structural collapse and post depositional faunal activities have been observed (Fig. 6.12 c). The overlying brown sandy clay loam unit 434, deposit Type 12a, is mixed with orange silty clay sediment aggregates of type 1 and building material debris and comprises ashes, small charred flecks and silty-size charred particles, which presumably represent windblown materials, transported and deposited, possibly when the structures of the adjacent SA III and SA I collapsed as possible result of conflagration (see Section 6.7.6).

More evident traces of burning were observed in thin section KVP14.7, from the south-eastern section of SA IIa, closed to the entrance of phase A. The dark brown sandy clay loam, unit 434, deposit type 12a, is mixed with calcitic ashes and comprises also limestone and cherts possibly

altered by fire (Fig 6.12 g), building material debris, which show traces of reddening, a ceramic fragment of sandy clay loam RP (deposit Type 13c) with traces of vitrification on its edges and silty clay loam burnt aggregates (Fig. 6.12 h). All of these evidence possibly suggest post depositional firing (see Section 4.3).

The occurrence of burnt deposits along the perimeter of the building-unit, and mainly on the eastern and southern walls, as evidenced by field observation and micromorphological analysis, possibly suggests that the fire did not spread to the entire area of the building. Presumably the fire was ignited in the adjacent building units SA I and/or SA III and possibly spread to the structures of SA II, accelerated by wind-blowing (Harrison 2004; 2008).

In SA IIb, field analysis revealed a similar sequence of destruction, characterised by the collapse of building materials from walls and roof, which included also a reddened layer of hardened mud materials, possibly from roofing structure (Fig. 6.14). This evidence, together with the good preservation of materials found on the last occupation floor of SA IIb, suggests rapid burial of the underlying deposits produced by the collapse of building-structures, which was possibly accelerated by the destruction of the adjacent wall structures.



Figure 6.14 Layer of reddened earthen building materials, (unit 421) possibly collapsed from the roof; SA IIb.

6.5.9 Conclusion and interpretations

The evidence analysed in building-units SA IIa and SA IIb suggests a use of space principally based on processing activities, as attested by the occurrence of grinding installations and tools

as querns/rubber stones and mortars, and related storing activities as indicated by the high number of semi-fixed vessels as pithoi, storage jars, and amphorae.

However, while in the interior of SA IIa the use of space remained unchanged, as suggested by the presence of grinding stations both in the early Phase B and late Phase A, with a tendency towards the enhancement of storing capacity (as also in SA I) and room representation (as the introduction of a white, fine plaster floor), in SA IIb temporal variations in use of space were more pronounced.

In SA IIb the passage from the early Phase B to the late Phase A was marked by a shift from dirtier/working activities to cleaner activities. This transformation is marked by an architectonic renovation of the built space with the introduction of a monolithic threshold, and an increase in number of valuable/prestige objects, as the imported juglet from the West, the askos and pendant, which may have had symbolic values and ritual functions, and the re-plastering of the room with a white, fine floor. These elements may be interpreted as products of a socio-cultural and economic transformation that affected the idea of ownership, security and social representation among the community members of Erimi-LtP at the beginning of Late Bronze period (see Chapter 8).

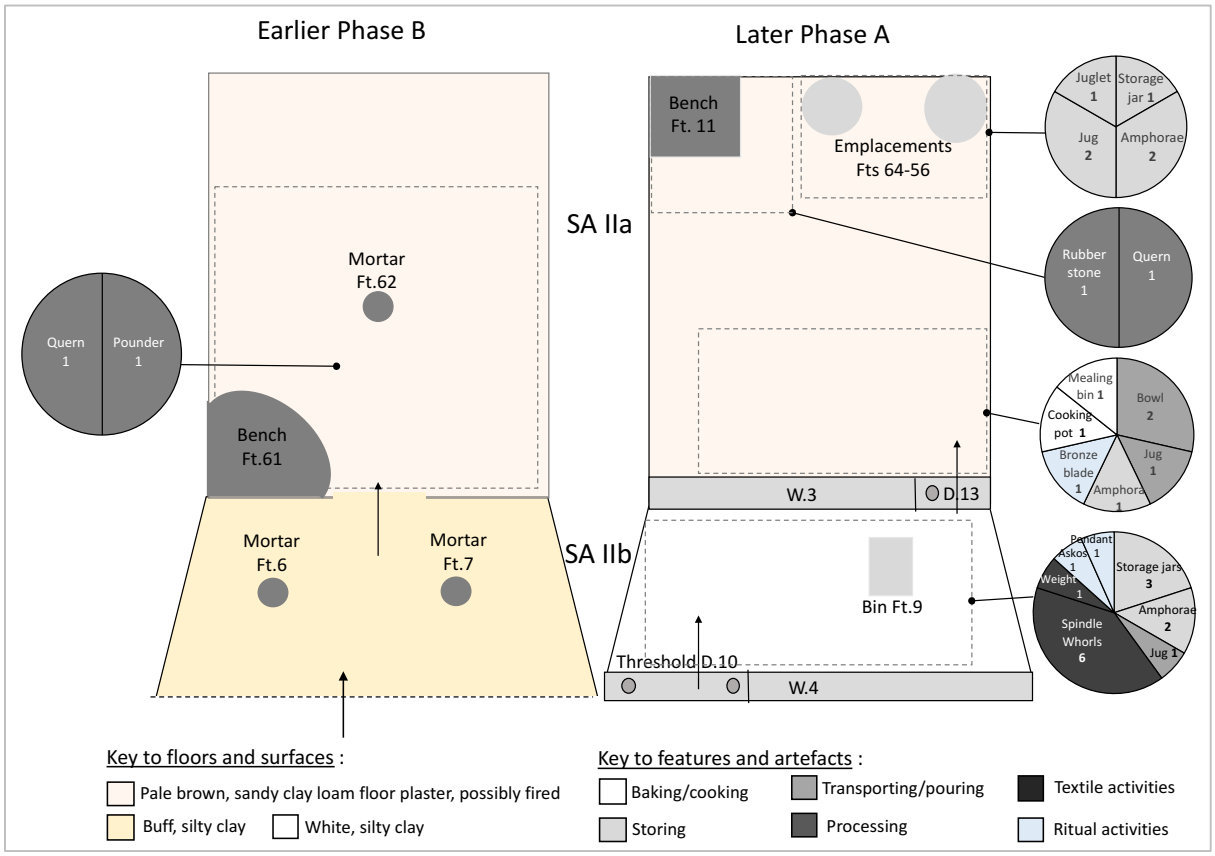


Figure 6.15 Variation in spatial organisation in unit SA IIa and annex SA IIb between the earlier Phase B and the later Phase A. The pie chart on the right of the plan show the distribution and occurrence of artefacts according to activities they are related to.

6.6 Area A. Building-unit SA III: spatial layout and construction.

Building-unit SA III was placed in the southern section of Area A, adjacent to building-unit SA II on the East and to building-unit SA IV on the West. The building was carved <60cm deep into the limestone bedrock, with the same orientation observed in the other building-units analysed. SA III was built with a quadrangular shape of 25.3 m^2. The inner space of SA III was organised as single unit.

SA III was not connected to a smaller annex, in contrast to that observed in SA I and SA II. It was directly accessible from the exterior open space. The building therefore was organised in order to be permeable from the outside and well integrated with the other buildings of Area A (see Table 6.2), so to suppose that public occasions, possibly connected with working activities were conducted in this space (see access graph, Fig. 6.3; Fisher 2007; 2009).

The primary access to building-unit SA III was on the south-western side, according to the spatial layout observed in the other building-units SA I and SA II. The doorway (D.55) was equipped with a limestone threshold, less elaborated than the ones of SA I and SA II. This threshold was possibly added in the later Phase A, as also in the other building-units of Area A, but the entrance was placed on the south-western corner of SA III since the early Phase B, as the foundation bedrock was carved in order to have an opening on that side. Through this doorway, SA III was in direct communication with the outdoor space and with an East-West oriented street/lane made of buff, sandy clay loam plaster mixed with pebbles and ceramic shards. This entrance, which possibly was the principal access to the building, was integrated with a back-door on the north-western side (D. 107), that connected SA III with the open area WA II. This doorway, differently from the main entrance, was not equipped with a threshold but only with a pivot-hole, carved into the bedrock floor (Fig.6.16 a).

Two occupation phases have been analysed in building-unit SA III; however only one layer of floor plaster has been observed in the occupation sequence, since in the early phase B the limestone foundation bedrock was directly used as floor, as illustrated in the stratigraphic graph Table 6.10 and described in Sections 6.6.3 and 6.6.4.

Table 6.10 Stratigraphic sequence of deposits analysed in building SA III. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Micro and macro materials
Post-abandonment	- *Top soil:*	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	Brown/Orange, silty clay loam and mudbricks debris [604, 609, 611, 614]; Dark brown sandy clay loam mixed to charred matter [618]; dark grey, silty clay ashes [605, 624], calcareous, sandy clay loam [606, 610];
	- ? Ritual	Rubber stones and dolerite river stones used to cover the occupation layer.
Use - Phase A	- Storage	Semi-fixed elements: 3 pithoi (one imported) 2 amphorae (one imported)
	- Cooking/heating	Portable objects**:** 4 cooking pots
	-Transporting/ pouring	Portable objects: 1 juglet 2 jugs 1 spouted jug 1 bowl
	- Textile	Portable objects: 1 spindle whorl
	- Processing/ grinding	Fixed and semi-fixed elements: Bench (Ft. 58) associated with a big quern Double quern in limestone (Ft. 57).
	- ? Ritual	Portable objects: 1 askos 2 pixydes 9 loom weights
Construction - Phase A	- Walls	*Yellow, sandy clay loam mud-bricks (Type 2b); white, silty clay bricks (Type 2c)* *White, silty clay wall plaster (Type 5)*
	- Doorway	Limestone threshold (D.55)
	- Internal structure	? Post-hole (Ft. 59)
	- Floor	*Buff, silty clay loam **floor plaster** ([634], F.1, Type 9b)*
Construction – Phase B	- *Internal structure*	Post-hole (Ft. 60)
	- *Doorway*	Main entrance (D.55) Back-entrance (D.102)
	- *Floor*	**Foundation bedrock floor** used as floor ([302], F.2)

6.6.1 Walls construction and materials

The wall building technique adopted in unit SA III, is similar to that of other buildings analysed in the settlement.

Two different brick types have been analysed in the collapsed walls of building-unit SA III. Yellow/brown bricks with smaller sizes of c. 0.20 x 0.13 x 0.06 m were recovered from the southern and eastern walls; while white bricks characterised by bigger sizes of c. 0.35 x 0.20 x 0.12 m, possibly manufactured using wooden moulds (see Section 5.3.2), were observed in a portion of the southern wall of the building-unit.

Micromorphology and XRF analysis on yellow brick KVP13.1 and natural sediments indicate that sandy clay loam sediment, possibly from weathered Miocene marl, was used in the manufacture of this smaller mud-brick, as also analysed in the other bricks recovered from SA II walls. White bricks instead were manufactured with a highly calcareous marl sediment, similar to the one used for yellow soil bricks, but higher in calcium carbonate, as verified by XRF analysis (Section 5.2.1). The presence of altered bioclasts embedded in the groundmass may suggest that post-depositional alterations occurred, possibly related to a fire event (see Sections 4.5.2 and 6.6.5)

The interior walls of SA III were coated with a layer of fine-white plaster, as observed in the field (see Fig.5.15). Rounded pebbles were set in the lower part of the wall, between the vertical surface and the floor, to make the application of plaster easier, to increase water tightness and plaster durability. This practice has been recorded in several Chalcolithic, Bronze Age and Late bronze age Cypriot sites as Kissonerga-*Mosphilia,* Alambra-*Mouttes*, Kalavassos-*Ayios Dhimitrios;* Alassa-*Paleotaverna* (Philokyprou 2011; 1998, 234-247) suggesting how similar techniques were wide-spread in different Cypriot regions and how functional building practices developed by prehistoric household communities were transmitted and re-adopted by protohistoric communities.

Micromorphological analysis on small wall plaster sample KVP13.8 revealed that it was produced crushing into aggregates of 500μm-2 cm in size the soft marl outcrop of Pakhna formation, which is characterised by the presence of sponge spicule (Robertson 1998) (see Section 4.4.5). The wall plaster colour, particle size and composition is similar to the plaster floor laid in SA III, suggesting that the same product was used to plaster the interior walls and floor of SA III in a single construction episode. This practice is commonly attested in Cypriot prehistoric building construction (Philokyprou 2011).

6.6.2 *Building-unit SA III, early Phase B: Architectural installations and artefacts, floor and occupation deposits.*

The early Phase B occupation is attested by very little evidence. Just one circular feature, possibly a post-hole (Ft.60; diameter 40 cm on the top, 16 cm on the bottom; depth: 36 cm), carved into the bedrock floor, characterised the inner space of this building-unit during the early occupation phase (Fig. 6.16 b, c).

The decentralised position of this feature excluded the possibility that the post-hole was part of the roof supporting system. Analysis conducted by architects working in the projects, which took in consideration building materials and techniques and building proportions and statics,

supports the idea that this post-hole was possibly part of a wooden structure, like a mezzanine, built within SA III (Tucci and Conti pers. comm.).

In the yellow sandy clay loam calcareous deposit, which filled the post-hole, part of a charred post was recovered. Botanical analysis on wood sections revealed that the wood fragment belongs to the *Olea* sp., olive (Gasson pers.comm); an arboreal species common in the middle area of the Kouris river valley, according to paleoenvironmental reconstruction conducted in this area by J. Burnet (2004, 56-57).

Artefacts pertaining to this occupation phase were not recovered. The limestone foundation bedrock was possibly used directly as a floor surface during this phase, as no traces of plastering nor white-washing were observed on this surface.

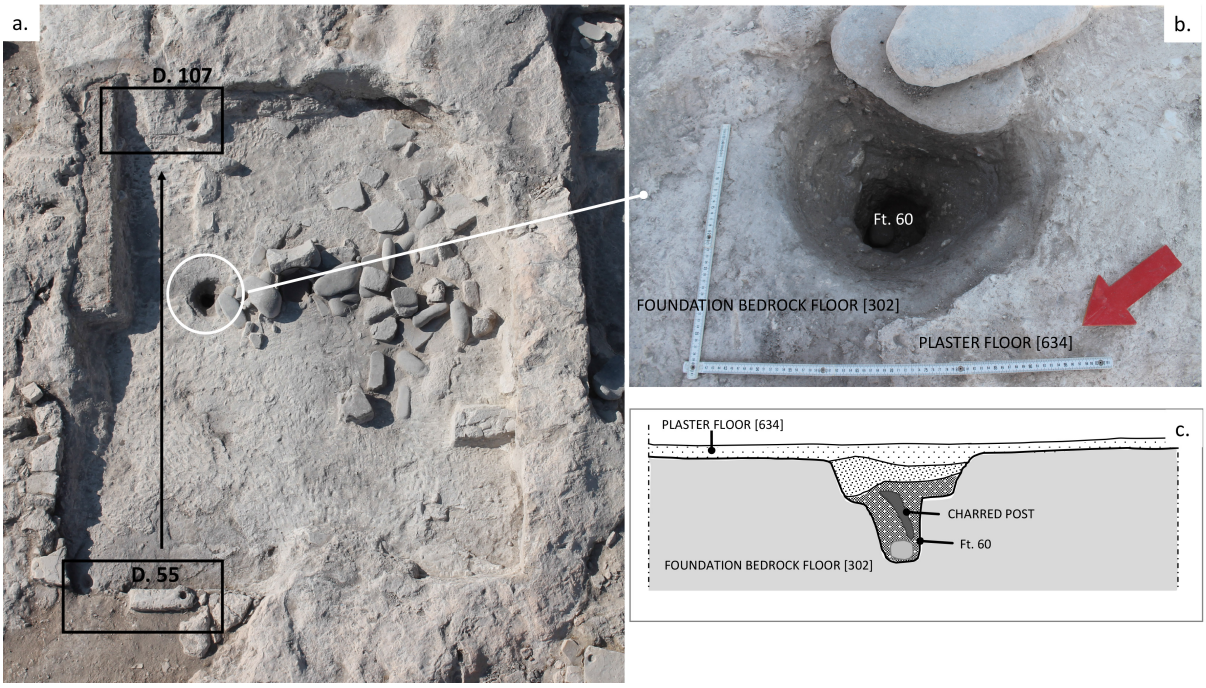


Figure 6.16 a) Building unit SA III with doorways placement and possible internal rout (black arrow). In the white circle post-hole FT. 60 pertaining to the early Phase B; b) Post-hole Ft. 60; c) Section of post-hole Ft. 60.

6.6.3 Building-unit SA III, late Phase A: Architectural installations and artefacts.

Building-unit SA III shows less temporal variation in the spatial layout between the early Phase B and the late phase A. However, it is difficult to reconstruct variation in use of space between the two occupation phases of this building-unit, as the limited data pertaining to the early phase B.

In the south-east section of the building-unit, opposite to the entrance, a small, rectangular bench in irregular stones bound with pale brown, sandy clay loam plaster, was constructed (Ft. 58; Dimension: 0.36 x 0.62 m), in association with a big dolerite quern of 0.4 x 0.25 m, hence

to suppose that grinding activities were carried out in this area of the building-unit. A series of semi-fixed vessels were placed along the eastern and north walls, closed to the bench. Among them three pithoi (two in RP and one in DP possibly imported from Paphos area; Graham pers.comm.) and three DP amphorae (one of them with incised decoration and horizontal handles is possibly imported from Paphos area; Graham pers.comm.) have been recovered, possibly associated with the grinding station. Another semi-fixed element, placed in the middle of the room stress the relationship of SA III with processing/grinding activities: a big limestone quern, worked on both the two sides, and particularly worn on one of them (Fig 6.17).

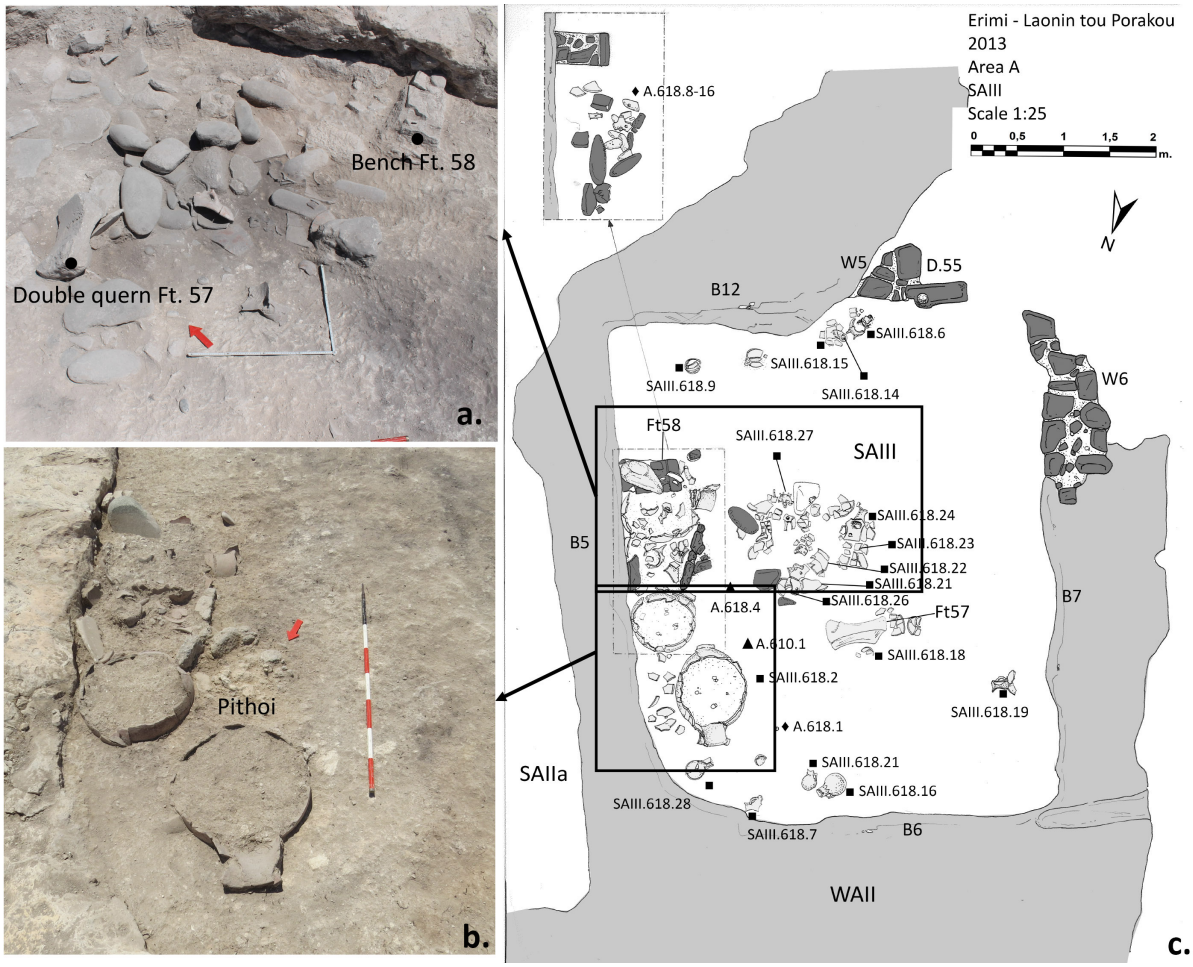


Figure 6.17 Building-unit SA III. a) Picture of south eastern corner of the building with placement of bench Ft. 58 and double quern Ft. 57. b) North east corner of the building with pithoi, c) Plan of SA III with distribution of fixed, semi fixed and portable objects.

The productive functions of this building-unit are attested also by the occurrence of four portable cooking pots, blackened by the exposure to fire, that were recovered in the eastern area of the building-unit together with a RP bowl, a DP juglet, 1 RP jug and a RP spouted jug, which were possibly used to transport and pour liquid or semi-liquid products.

While the bench and artefacts support the idea of SA III as productive space connected to processing and storing activities, other evidence endorse the idea of a possible coexistence

between utilitarian as well as symbolic objects and the possible ritual activities within this building. This idea is stressed by the occurrence of prestige/symbolic vessels as two DP decorated pyxides, one RP goat-shaped askos (Fig. 6.18 a), a biconical spindle whorl that is more frequently attested in funerary contexts at Erimi-LtP, and a group of nine conical 'loom weights' made of unfired clay (Dimension:0.06-0.18 m hight x 0.06-0.07 m width; Fig. 6.18 b). These last-mentioned artefacts are of a particular relevance in the definition of 'symbolisation process', a practice through which a common use object is transformed and embedded of symbolic values (Bombardieri 2017). These loom weighs indeed were not of practical use, as the absence of suspension holes to tie them to the loom; only two of them show an impression in their top part, as to reproduce the suspension hole. These evidence may suggest that these objects were possibly embedded with symbolic values; presumably they represented the community identity based on economic resources and settlement activities (Bombardieri 2017).

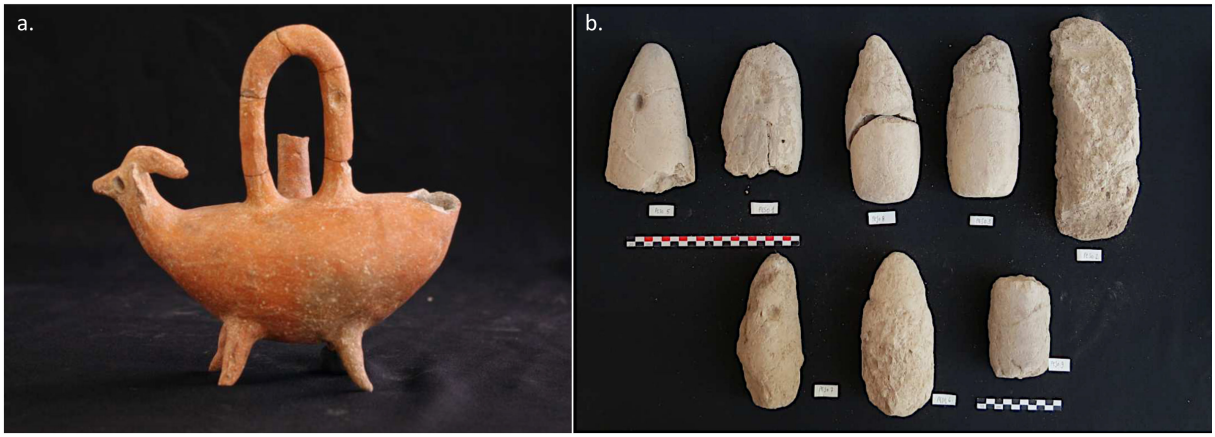


Figure 6.18 a) Askos and b) loom weights recovered within building-unit SA III.

It is difficult to determine if these objects were related to activities carried out in building-unit SA III during its occupation or if they were deliberately deposited in this unit, as form of ritualization, when the settlement was abandoned.

The western area of the building-unit was emptier, with the exception of a fragmentary jug in RP, recovered within the pale-brown sandy clay loam destruction deposit overlying the floor. The absence of artefacts from this area may suggest that this section of the building-unit was possibly used as passageway in correspondence with the two doorways (Fig. 6.16).

6.6.4 Building-unit SA III Late Phase A: floors and occupation deposits.

In the late Phase A, 2 cm thick layer of floor plaster was laid on the middle and eastern section of building-unit SA III. The new floor plaster was applied on the bedrock floor without any

floor preparation, differently from the common practice attested in building-units SA I and SA II.

The white silty clay floor plaster KVP14.31 is similar in colour, particle size and inclusions to the material used to coat the internal walls of SA III, hence to suggest that the same plaster was used both for the floor and the walls of the building-unit, as previously discussed in Section 6.6.1.

The absence of undisturbed blocks from the middle and east area of SA III, limited the possibility to recognise possible micro residues, pertaining to the use of this building-unit. At macroscopic level, thick occupation residues were not observed. Stratigraphic analysis indicates that the plaster floor of Phase A is covered by the destruction deposits, composed by patches of ashes and burn debris [605, 610], mixed to intact and degraded bricks and calcareous sediment [618] (see Section 6.6.5).

The western area of SA III is characterised by a different depositional sequence. A pale-yellow, sandy clay loam, different in colour and composition from the floor plaster and overlying destruction deposits, was observed in the western section of building-unit SA III. An undisturbed block of 0.13 x 0.06 m was collected from this section to analyse the depositional sequence in the western area of SA III and to study the possible occurrence of artefactual and bioarchaeological residues embedded in these deposits.

The foundation bedrock is overlain by a 9cm thick layer of yellow/pale brown, sandy clay loam deposit, Unit 619 (Thin-section KVP13.171). A wide range of materials mainly of inorganic origin, as sand size limestone, fine-sand size cherts and micro-architectural debris, including a sequence of plaster layers with traces of red paint (Fig. 6.19 e) have been identified mixed to the calcareous sediment. The compaction of the surficial part of the reactive zone of this layer and the occurrence of >5% of ferruginous impregnations (Fig. 6.19 d) possibly suggest that the surface was covered by impervious material as wooden planks that reduced the effects of mechanical disturbances and retained moisture below the cover (Gè et al. 1993). This evidence together with the placement of this deposit, on the western area of the building-unit, in correspondence to the two doorways, may possibly indicate that a raised platform was constructed in this area of SA III, presumably used as passageway within the building (Fig. 6.19).

The upper deposit, Unit 610, is a pale brown calcareous layer, similar in composition to Unit 619, but richer in silty size charred particles (5-10%), which possibly formed ad degradation

or destruction of structural material, mixed with wind-blown charred material. In contrast with Unit 619, this deposit is less compact and more strongly bioturbated as its proximity to the topsoil, where faunal and floral activities are more frequent.

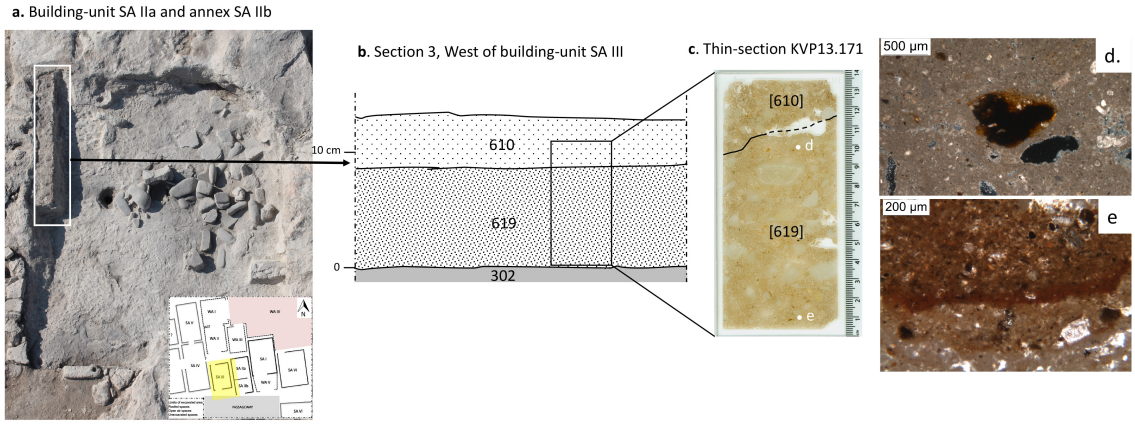


Figure 6.19 Microstratigraphy of floors in building-unit SA III a) Aerial photo of building-unit SA III with placement of section 3 (white rectangle) on the western side. b) Section 2 with the sequences of floors, as analysed in the field. c) Thin section KVP13.171 represents the sequence of calcareous packing layers, units 619 and 610, deposit Type 10a. d) Photomicrograph of impregnative redox pedofeature in packing deposit 619; PPL. e) Photomicrographs of a plaster sequence (500µm), as residual building material mixed to the calcareous packing layer. A layer of red clay, possible paint, is in between two silty clay loam plaster layers, on red/brown (on the top) and one yellow/brown (on the bottom); OIL.

6.6.5 Building-unit SA III: Abandonment process

Field analysis revealed the occurrence of a 10-15 cm thick layer of brown silty clay loam, unit 618, not homogeneously distributed on the plaster floor of Phase A. This layer is mainly deposited on the eastern and central area of the building-unit; It covers almost completely all the artefacts observed on the plaster floor of SA III. The lack of macro residues of occupation including botanic residues, as observed by floatation and archaeobotanical analysis, possibly suggest that the sterile sediment was deliberately accumulated within the building-unit to cover the last occupation surface of SA III and the materials deposited within it (La Motta and Schiffer 1999, 22-24). This hypothesis may be further confirmed by the occurrence, of a layer of igneous stones from the river valley and re-used rubber stones and limestone blocks that were deposited together with the sterile layer possibly to symbolically seal the material assemblage left on the last occupation floor (Toufexis 2006, 58; Knapp 2013a, 237). A similar practice has been also observed in of the largest and richest tomb of the funerary Area E, T. 428, which was completely filled with a deposit of limestone blocks and field stones mixed to pale brown sandy clay loam, hence to possibly indicate an intentional and planned ritual practice, possibly connected to closure ceremonies (Souvazi 2008; 30, 201-203).

These deposits, are covered by <10 cm thick layer of destruction sequence, which includes brown, orange silty clay, silty clay loam possibly pertaining to disaggregated mud-bricks [604], collapsed mud-brick walls [614], pale brown-yellow carbonate sandy clay loam deposits mixed to plaster chunks possibly pertaining to the collapse of internal plaster coating [609], and silty

clay loam charred deposit mixed to ashes and building material debris, possibly pertaining to the burning of wooden structure and collapse of roofing materials [605, 617, 624].

Undisturbed block KVP14.6, which was taken from the exposed section on the eastern wall of SA III, and the related thin-section, shows the sequence of brown, sterile layer, unit 618, overlain by the silty clay loam burnt layer unit 617, deriving from the possible firing of wooden structures. In unit 617, characterised by a brown sandy clay loam, the reddening of iron bearing clay, may support the hypothesis of post-depositional firing. The irregular and diffuse boundary of this deposit may possibly derive from breakage and deterioration caused by structural collapse. The burnt layer, unit 618, is mixed with ashes and charred matter together with sparse spherulites, which may be interpreted as possible disaggregated residues of dung. According to Twiss et al. (2008) spherulites mixed with burnt debris may also indicate the usage of animal fuel to deliberately burn the structure. However, this possibility is not verifiable on the basis of the discussed evidence, and spherulites may also be residues of organic tempers mixed to the silty clay of bricks and roofing materials.

It is difficult to confirm if the firing event was deliberate. The fire was fairly extended, and two possible ignition points were noted within the building. One point is on the southern area, in proximity of the main doorway (Fig. 6.20). The exposure of the southern mud-brick wall to elevated temperatures resulted in the discolouration and reddening of the bricks, as analysed by micromorphology and spectroscopic analyses (see Section 5.4). Fire also hardened mud-bricks, and allowed their preservation in the archaeological record (Stevanovic 1997). The second ignition point is at the centre of the building and caused the hardening of the underlying deposit, unit 618, including the loom weights made of unfired clay, which were deposited in that area (see Section 6.6.3).

The hypothesis of accidental burning cannot be excluded; however, it is worth noting that mudbrick structures are difficult to ignite without accelerants and additional fuel, as demonstrated by experimental analysis and forensic fire investigations (La Motta and Schiffer 1999, 23; Cameron 1990; Seymour and Schiffer 1987, Verhoeven 2000; Harrison 2004; 2008). At the same time the idea of a possible arson, even if not verifiable, may be further supported by the analysed archaeological evidence, e.g. the occurrence of stones and sterile sediment to seal the occupation surface; the occurrence of possible ritual objects and prestige vessels within the assemblage, that led to suggest possible abandonment ritual practices, involving also the burning of SA III structures (Stevanovic 1997; Stevanovic and Tringham 2001; Cessford and Near 2004; Verhoeven 2000).



Figure 6.20 Possible ignition point nearby the entrance of building-unit SA III, characterised by dark burnt patches and discoloured and hardened layers of sediment. Building materials debris as mudbricks and limestone blocks are mixed with the dark, burnt layer.

6.6.6 Conclusion and interpretations

The analysis of building-unit SA III revealed a depositional sequence characterised by the occurrence of only one layer of floor plaster, in contrast with that observed in building-units SA I and II, which are characterised by a sequence of two distinct layers of floor plaster. Transformations in the spatial layout and temporal variation in the use of space are less pronounced in SA III, also due to the limited evidence pertaining to the early Phase B occupation.

In the late Phase A, the introduction of a fine, white wall and floor plaster may indicate that this building-unit was not organised only as working space, also on the basis of comparisons with the adjacent building-units SA I and II, which were constructed with coarser floor plaster layers (see cladistic diagram Fig. 6.26). Furthermore, the syntactic characteristics of this building, which was organised to be directly connected with the exterior lane/passageway and easily accessible from the outdoor space, as well as the coexistence of functional as well as prestige/ritual objects may confirm the idea of SA III as presumed representative building, where public and possibly ritual activities were carried out together with working activities (see Section 6.6.3). This dual aspect is more attested during the later Phase A, when the economic development of Erimi-LtP led to reinforce the social identity of community members, which possibly identified themselves using common symbols, ritual and communication forms. This idea may be further confirmed by evidence from abandonment layers, which testify possible ritual practices, which involved the burning of building structures (Koutrafouri 2008; Bell 1997; Tringham 2005, 108; Stevanovic 1997; Twiss *et al*. 2008).

6.7 Area A. Building-unit SA VI: spatial layout and construction.

Building-unit SA VI is the easternmost roofed unit among those constructed in Area A. The internal space of this building-unit was carved at an inferior depth of 0.50 m into the limestone bedrock floor. The building-unit was built with a North-South orientation and a rectangular shape as the other roofed building of Area A. The space of 19.5 m^2, is narrower than the other building-unit analysed (see convexity score <0.7, Table 6.2), so to suggest a possible use as 'movement space'. As well as SA III, building-unit SA VI was organised as single unit, and not connected to a smaller annex. Therefore, it was easily accessible from the outdoor space.

The most pronounced change in the spatial layout of SA VI compared to the other roofed buildings of Area A, is in the placement of the doorway on the north-western side, instead on the southern-east side, as observed in SA I, SA IIb and SA III. This different layout may derive from the fact that this unit was designed as open-area in the early Phase B and, it was turned into a building-unit only in the later Phase A, as illustrated by the access graph (Fig. 6.3) and suggested in Sections 6.7.1 and 6. 7.2. This entrance was built to connect SA VI to the big open-area/courtyard WA VI.

Multiple layers of floor plaster mark three different episodes of construction and architectural renovation within building-unit SA VI, as illustrated in the stratigraphic Table 6.11.

Table 6.11 Stratigraphic sequence of deposits analysed in building SA VI. Abbreviations and codes: D. = doorway, followed by field no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by field no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Field interpretation	Micro and macro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [342] turbated by faunal and floral activity and organic decay
Abandonment	- Destruction:	Collapsed limestone walls [643, 647, 658] Dark brown, sandy clay loam mixed to ashes and burnt debris (Type 12a); Orange, pale brown, sandy clay loam mixed to architectural materials debris, (Type 12b).
Construction-Phase A2	- ?Doorway	Limestone mortar (Ft. 85) reused as door jamb support or pivot stone ?
	- Floor	Limestone slabs **Floor** ([628], F.15) *White silty clay **floor plaster*** ([681c], F.14; Type 9a)
Use- Phase A2	- Processing/ transporting	Portable objects: 2 DP juglets 2 RP jugs 7 RP bowl 1 CW mealing bin 4 Chipped stone tools Semi-fixed elements: 1 dolerite rubber stone *Micro-materials: grey silty clay loam with 5% charred materials (Type 11b)*;
	- Wall	Limitation wall in limestone blocks ([680], W.7)
	- Floor	*Buff silty clay loam fired **floor plaster** ([681a], F.8; Type 9b)*

Construction - Phase A2	- Packing	*Pale-brown/brown silty to sandy clay loam constructional packing ([696], Type 10a)*
	- Floor	*White, sandy clay loam unfired* ***floor plaster*** *([697], F.9, Type 9d)*
	- Infilling	Pale brown/yellow, calcareous sandy clay loam infilling the basins.
Use – Phase B	- Textile activity	Portable objects: 1 spindle whorl
	-Sweeping	*Micro-materials: Rounded, sorted inorganic aggregates, mixed to an orange, calcareous sandy clay loam occupation deposit (Type 11a).*
	- Processing/	Fixed elements: Squared and circular basins carved into the bedrock floor and coated with pale brown, sandy clay loam plaster (Type 8b): Fts. 74, 78, 84, 88, 89, 90, 91. Portable objects: 1 fragmentary milling bin *Micro-materials: grey silty clay loam with 5% charred materials within basins (Type 11b);*
Construction- Phase B	- Walls	*Red-silty clay loam bricks (Type 2a);* *Red/ brown, sandy clay loam construction material, possibly roofing structure (Type 3)*
	- Floor	**Bedrock floor** used as floor ([699], F.10)

6.7.1 Walls construction and materials

The evidence pertaining to SA VI wall structures indicates that the construction technique used is similar to that of other building-units analysed. The western wall of the structure, shared with building-unit SA I, was probably constructed with more than three/four courses of stones and limestone blocks, as suggested by the high occurrence of stones and stone derbies in the destruction layers pertaining to the collapsed western wall (Fig. 6.21). The evidence about the occurrence of more courses of limestone blocks in this wall, sheds light on the possibility that this limit structure needed to be reinforced as possibly more exposed to erosion and deterioration than other wall structures analysed (see Section 6.7.2).

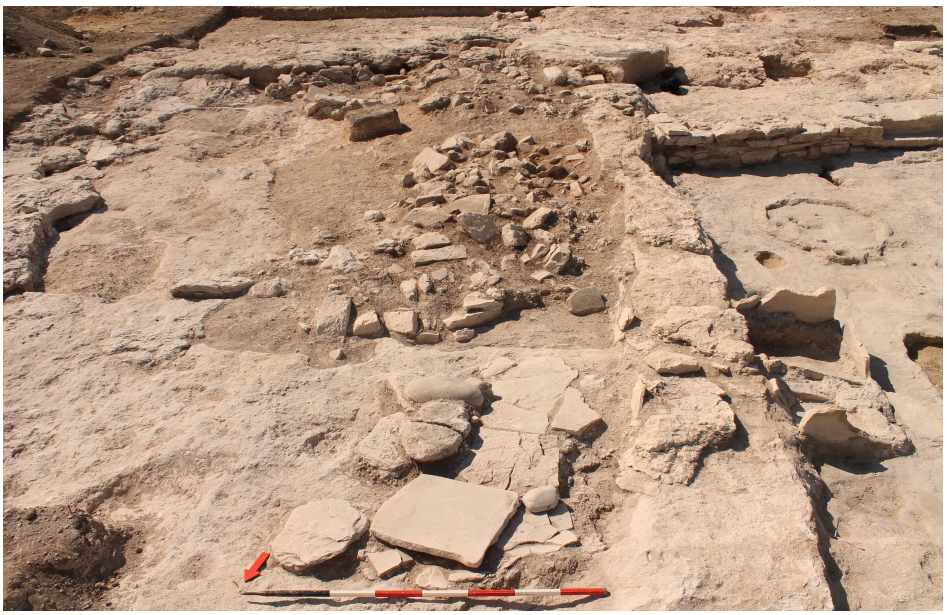


Figure 6.21 Building-unit SA VI, with the s collapsed western stone walls.

6.7.2 Building-unit SA VI, early Phase B: Architectural installations and artefacts

In the early occupation Phase B, the western and eastern sections of SA VI were separated each other by the different depth the foundation bedrock was carved; the western side of the building-unit was carved at a major depth of 50 cm while the eastern side was carved at a depth of 20 cm., approximately at the same level of the other open-areas. In the southern section of the building-unit the segregation between the wester and the eastern areas was marked by a line of small post holes of 2 cm that possibly supported a small wooden fence.

The internal space of SA VI was furnished with a series of fixed installations constructed as rectangular and circular basins (Fts. 74, 78, 84, 88, 89, 90, 91) of different sizes (dimension of rectangular basins: 0.90 x0.90 m approximately; dimension of circular basins: 0.30-0.60 m), distributed both in the western and eastern sections of the building-unit. All of them were carved into the bedrock floor, with depths of 27-15 cm, and were coated with a pale brown, sandy clay loam plaster. On the south-western corner of the room a big basin of 1.24 x 0.7 m, carved into the bedrock floor with a depth of 70 cm, was possibly used as container for water collection, since it was connected with the deep channel Ft. 39, of the adjacent building-unit WA V (see Section 6.4.6). The lack of materials, with exception of a Black Polished spindle whorl and a fragmentary mealing bin in coarse ware, does not support the reconstruction of activities and use of space in this room during this early phase. However, on the basis of mentioned installations, it is possible to presume that the building-unit was used as space where processing activities, including the use of liquid products and water, were carried out.

6.7.3 Building-unit SA VI, early Phase B: floors and occupation deposits

The study of building-unit SA VI was supported by the collection of three undisturbed blocks and respective micromorphological analysis of thin-sections. The first undisturbed block was taken from the exposed northern section of the building-unit, where a sequence of floor plasters pertaining to different phases of occupation and renovation of SA VI was observed; the second and third blocks were sampled from the middle and south sections of the building-unit, where depositional sequences of occupation and destruction deposits were analysed.

Field analysis revealed that during the early Phase B building-unit SA VI was characterised by the absence of prepared floors; this evidence, together with the presence of basins carved into the bedrock floor, possibly validate the idea that this building-unit was used as open-working area, similarly to WA I and WA IV.

Thin section KVP14.2, from section 1, on the norther area of the building-unit, shows that the foundation limestone bedrock was used directly as floor, with the natural marl floor,

characterised by well-bedded layer of compact white-yellow micritic deposits alternate to yellow, void-rich micritic deposit (Fig.6.22 e; unit 699, deposit Type 1; Robertson et al. 1991, Durand et al. 2010,157-158). The sharp and wavy boundary of the marl floor, unit 699, may possibly suggest that in this area the floor was covered by wooden planks (Courty et al.1989; Shillito et al. 2014). The natural floor is overlain by a 1,5 cm thick layer of orange/pale brown, sandy clay loam sediment, mixed with limestone inclusions of different size and rounded sediment aggregates, *unit 698 (deposit Type 11a). The colour and composition of the deposit, similar to bricks Type 2a, and the occurrence of this deposit in proximity of the western wall suggest that the unit 698 was presumably originated from bricks degradation, possibly caused by rainwater, which washed the mud down the wall and/or by wind abrasion and deposition, and accumulated during occupation (see Section 4.4.12). The degraded brick material possibly filtered into the plank fissures and deposited on the floor. Another possibility is that these abraded materials were swept, and dumped in a corner of the building-unit, as suggested by the sorted grain-size distribution of the rounded aggregates (Fig. 6.22 f; Miller et al. 2010). The occurrence of degraded brick material, deriving by erosion of building structures by natural agents, may represent further evidence to support the idea of SA VI as an open-area during the early phase of occupation.*

In thin-sections KVP14.3 from the south-middle section of SA VI, the natural marl floor, unit 699, does not show any residues accumulated on it (Fig. 6.23). The absence of occupation residues, as also observed in other floors analysed, may be representative of maintenance practices involving the cleaning of the surfaces, and possibly indicate particular socio-cultural habits, rituals and perception of comfort and cleanliness in working areas (Milek 2012). Differently in thin-section KVP14.4 from the southern section of SA VI, the marl floor was carved to build a pit, which shows 1 cm thick layer of grey silty clay loam with >5% of charred material particles and sediment aggregates possibly deriving from degradation of building materials (type 1). The presence of charred silt size particles, deposited within the pit structure, may be interpreted as residual material of activities, which possible involved the use of fire or discarded charred residues from hearth (Fig. 6.24; see 4.5.11).

6.7.4 Building-unit SA VI, late Phase A: Architectural installations and artefacts

The subsequent Phase A is characterised by two sub-phases, the earlier sub-phase A2 and the later sub-phase A1, identified through the analysis of variation in the spatial layout, mainly marked by the occurrence of multiple layers of floor plasters.

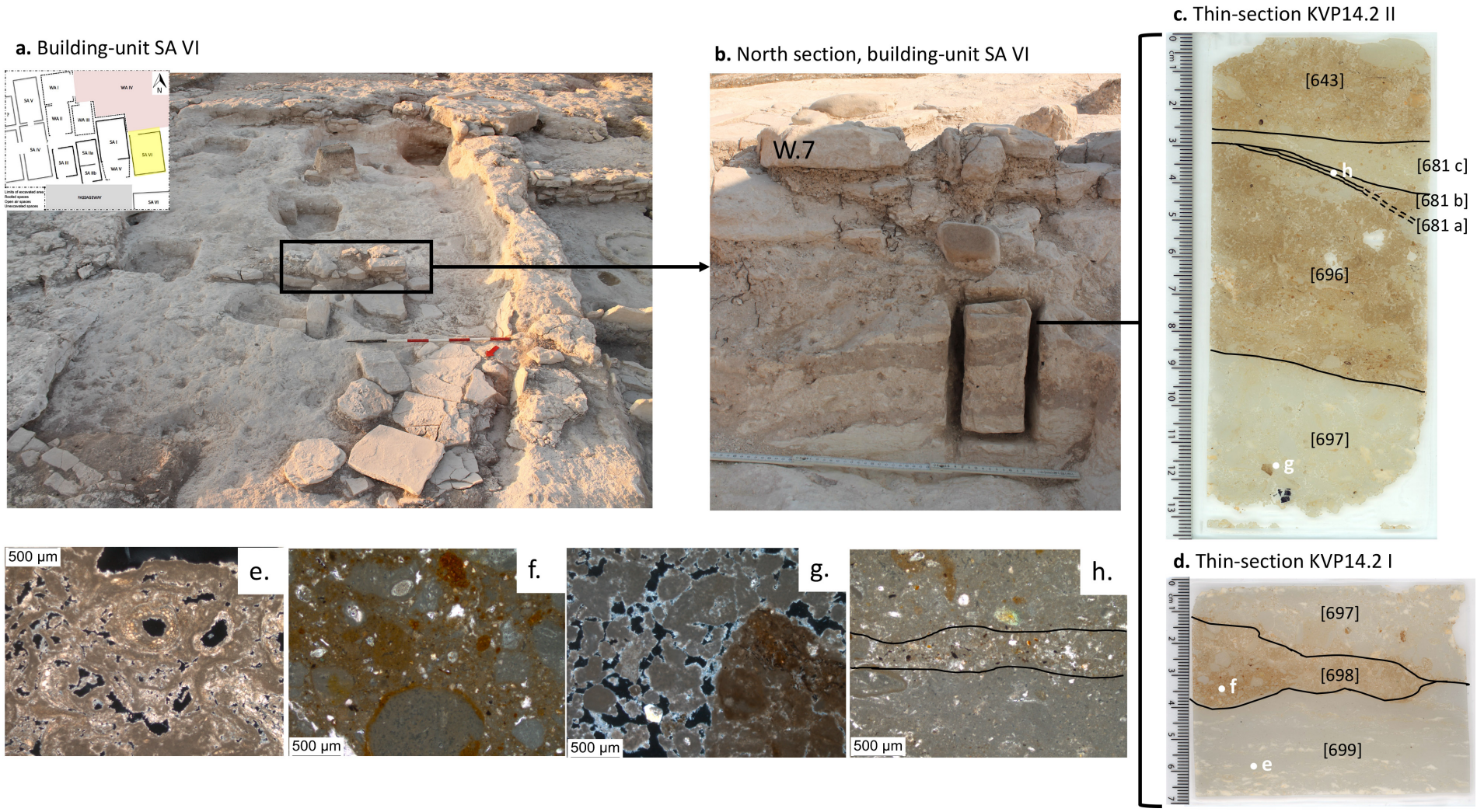


Figure 6.22 Microstratigraphy of floors in building-unit SA VI. a) Aerial photo of building-unit SA VI with the placement of North section (black rectangle). b) North section and undisturbed micromorphological block sample with the sequences of floors. c-d) Thin sections KVP14.2 I, II represent the sequence of floors and occupation deposits in the northern area of SA VI. e-h) Photomicrographs of: e) Calcitic pseudomorphs after plant tissue in foundation bedrock floor, unit 699, deposit Type 1, PPL; f) Clay coating and rounded orange silty clay aggregate in degraded brick material unit 698, deposit Type 11a, PPL; g) 'Linked and coated' (gefuric) related distribution of floor plaster unit 697, deposit Type 9d, characterised by sand size limestone coated by secondary calcite, XPL; h) Thin occupation deposit unit 681 b (deposit Type 11b) , characterised by silty size charred particles; it overlies the silty clay floor, unit 681a (deposit Type 9a) of Phase A2 and is it covered by the silty clay loam plaster floor, unit 681 c (deposit Type 9b) of Phase A1, PPL.

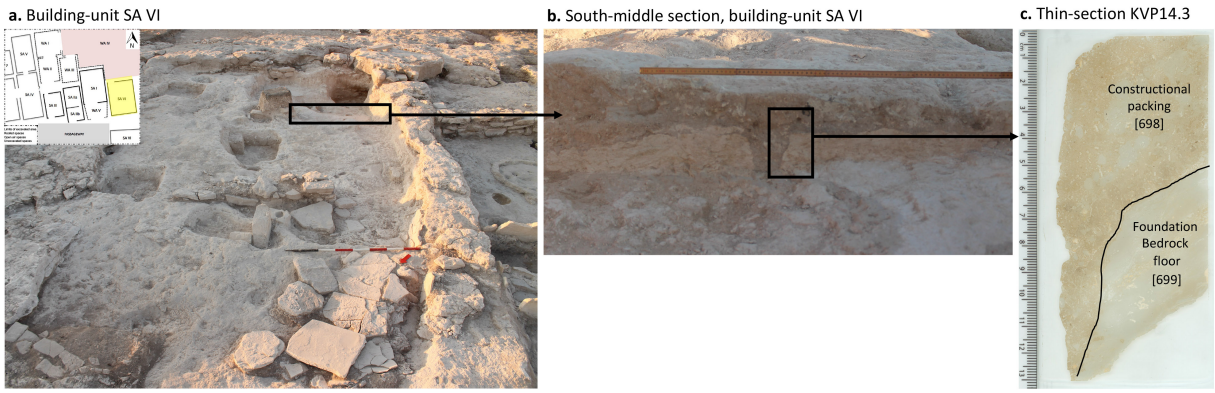


Figure 6.23 Microstratigraphy of floors in building-unit SA VI. a) Aerial photo of building-unit SA VI with the placement of South-middle section (black rectangle). b) South-middle section and undisturbed micromorphological block sample marked by the black rectangle. c) Thin sections KVP14.3 represents the sequence of floors in the south-middle area of SA VI. The marl foundation bedrock floor, unit 699 (deposit Type 1) was carved during the early Phase B to construct a small post hole of 5 cm in diameter; in the later phase A2 the post hole was filled with a sandy clay loam packing of calcareous material, unit 698, deposit Type 10a.

In the earlier phase A2 the space of building-unit SA VI was completely renovated with the introduction, on the norther side of the unit, of a limit wall in dry stone masonry, built with irregular limestone blocks and pebbles (W7). The limit wall was constructed to enclose completely the unit-space in order to turn it into a roofed-closed building. A 1m width entrance, was placed on the north-western side of the building-unit; however, the access is not marked or embellished by architectonic elements as threshold or pivot stone. The total absence of architectural installations and artefacts, recovered from this space does not support any interpretation about possible activities carried out in SA VI during this period.

In the later phase A1 the spatial organisation of building-unit was not changed; the only exception is represented by the entranceway that was furnished with a ‘corridor ‘in limestone slabs [628, 700] laid on a thin layer of yellow, fine plaster. A limestone mortar (Ft. 85), was placed in the proximity to the entrance and possibly re-used as door jamb support or pivot-stone, since in an uncomfortable position to be used as processing tool.

A limited number of artefacts have been recovered from the last occupation surface of SA VI, mainly from the south-eastern area. These are mainly open vessels, notably RP bowls, and are associated with ‘pouring vessels’, as represented by two medium size RP jugs and a DP juglet. From the western side of SA VI just a fragmentary DP juglet and a milling bin in coarse ware, associated with a rubber stone have been recovered.

6.7.5 Building-unit SA VI, late Phase A: floors and occupation deposits

The micromoprhological analysis of depositional sequences supplemented the limited data from the study of architectural and artefactual evidence, and supported the analysis of spatial and temporal variation in the use of space in building-unit SA VI.

Changes in the use of space in SA VI are mainly represented by the occurrence of multiple layers of floor plaster that mark different occupation phases and represent possible diverse socio cultural and economic developments in the community of Erimi-LtP between the early Phase B and the later Phase A.

The occupational sequence of SA VI is very well represented by thin section KVP14.2 on the norther section of the building-unit. The new occupation phase A2 is marked by the construction of a 7 cm thick layer of floor plaster, which mark the architectural renovation of the building-unit SA VI. The basins in use during the early Phase B were closed by a pale brown, calcareous sandy clay loam infill mixed with discarded materials including building material debris and ceramic. The variation in floor depth from the western and eastern area of the building- unit, which characterised the interior building space in the early Phase B, was levelled out by this thick floor plaster layer. A large, single roofed unit was created with the construction of the norther limit wall, W7.

The introduction of a 7 cm thick layer of white sandy clay loam floor plaster, unit 697 (deposit Type 9d) marks the change in use of the building-unit. The new plaster floor is characterised by a 'linked and coated' (gefuric) related distribution that suggests that this plaster was not fired but was produced crushing limestone, possibly discarded from building/carving activities, and mixing it with water (Fig. 6.22 g; Wright 2005, 147). Spectroscopic result supported this hypothesis, showing how values recorded in this plaster type are similar to those recorded in local limestone samples, suggesting that this floor was not produced with fired lime (see Section 5.3.3).

Occupation residues were not observed on the sharp and regular boundary of floor plaster unit 697. The lack of micro residues of occupation and the absence of working installations and artefacts, may possibly indicate a shift from productive/dirty activities to cleaner/representative activities possibly resulting from improved economic system and emerging social representation, as more widely discussed in Chapter 8.

The floor plaster unit 697 is overlain by 5.5 cm thick layer of heterogeneous packing deposit that comprises calcareous sand, mixed with local lenses of calcitic ashes, charred flecks, architectural material debris and natural marl fragments. The homogeneity and compaction of

the groundmass with random distribution of course fraction, and the occurrence of micro-lamination of finer material and sub-horizontal voids in the reactive zone of this layer may be indicative of trampling. On the uppermost part of the deposit the occurrence of well sorted fine material, may be the result of burnishing, possibly to reduce the pores and the occurrence of coarser material on the surface of this sub-floor packing.

The overlaying layer, unit 681a (deposit Type 9a), is a 1mm thin layer of white, silty clay floor plaster, possibly from unfired havara, which was laid on the floor packing. The application of a thin layer of white plaster coating over a preparatory coarser packing, is a practice also attested in other Cypriot Chalcolithic and Early bronze age sites as Kissonerga- Mosphilia and Marki-Alonia (Philokyprou 1998; 2011). The choice of applying only a thin layer of white plaster over a courser and heterogenous preparatory floor packing, instead of a thick layer of fired plaster floor, is possibly representative of a variation in the use of space or may have depended on a lack of available plaster material, due to the seasonality of plaster production (Wright 2005, 143-178), more than be the result of a socio-economic and technological regression as proposed by studies on development of lime pyrotechnology in Bronze Age Cyprus (Philokyprou 2011).

The hypothesis of a change in the use of space and of a possible shift to dirtier activities and/or to different maintenance practices, is represented by the occurrence of a 1 mm thin layer of occupation deposit, unit 681b (deposit Type 11b), on top of the thin floor plaster (Fig. 6.22 h). The occupation deposit is characterised by silty size black particles of soot or dust and by micro lumps of orange silty clay sediment aggregates (type 1). The occurrence of this occupation deposit is even more significant considering the cleanliness of the other floors analysed in the same sequence.

The new occupation phase A1 is represented by the introduction of a 1.5 cm thick layer of buff, silty clay loam floor plaster, produced with fired calcite, and mixed with orange aggregates and organic temper, unit 681 a (deposit Type 9b). The construction of this floor plaster, mark the last phase of occupation of SA VI, and it is contemporary to the construction of the floor/corridor in limestone slabs [628, 700] (see Section 6.7.4), which is possibly indicative of an improved architectonic elaboration and role and representation of the building space.

Differently, in the southern section of building-unit SA VI, represented by thin section KVP14.4, the white, unfired plaster floor of sub-phase A2 (unit 697, deposit Type 9d), is overlain by a 1.5 thick layer of occupation deposit -unit 689 (deposit Type 11b)- that comprises carbonate sandy clay loam, mixed with silt size particles of charred matter and rare burnt aggregates; these

charred particles and burnt aggregates may represent residual material of activities, which possible involved the use of fire (Fig. 6.24). The absence of other layers of floor plaster on top of the occupation deposit unit 689, and the occurrence of a different micro-depositional history, may be indicative of a different use of the space between the north and the south section of building-unit SA VI.

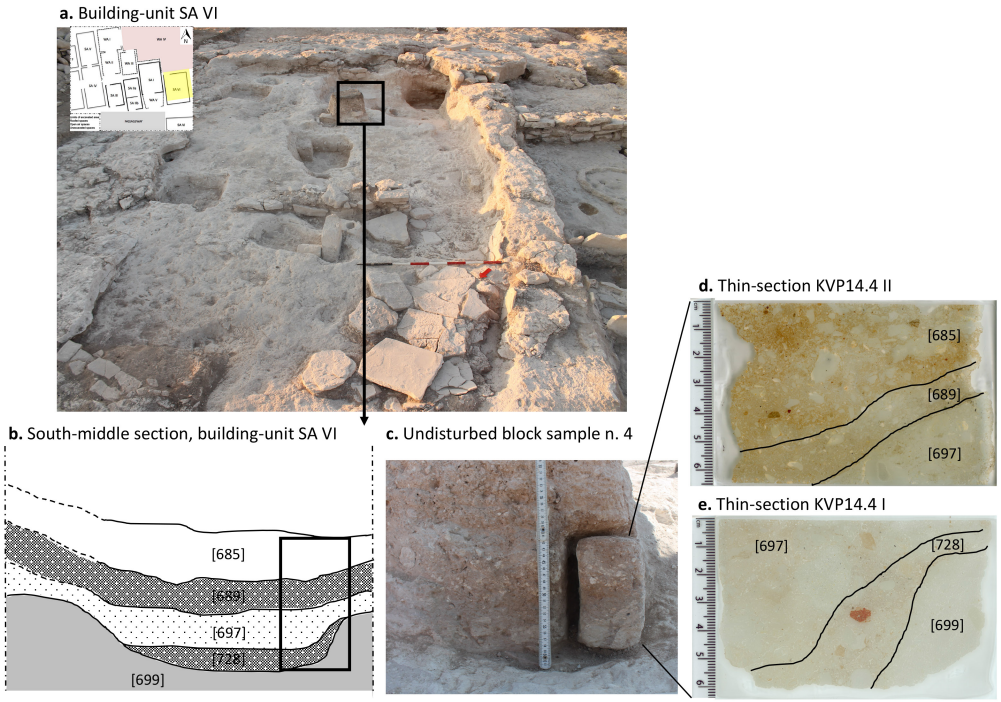


Figure 6.24 Microstratigraphy of floors in building-unit SA VI. a) Aerial photo of building-unit SA VI with the placement of South section (black rectangle). b-c) South section and undisturbed micromorphological block sample marked by the black rectangle. d-e) Thin sections KVP14.4 I, II represent the sequence of floors in the southern area of SA VI. The marl foundation bedrock floor, unit 699 (deposit Type 1) was carved during the early Phase B to build a small pit, where resides of occupation have been identified, including charred materials and sediment aggregates.

6.7.6 *Building-unit SA VI: Abandonment process*

Field analysis revealed the occurrence of >15 cm thick layer of destruction deposits characterised by the collapse of different building materials deposited on the interior building-unit SA VI, when the structure was abandoned. These destruction layers include orange and pale brown, calcareous sandy clay loam, where partially preserved mud-bricks and possible roofing materials were recovered [643, 685]; dark brown, sandy clay loam mixed to ashes and burnt debris [688], covered by a layer of collapsed limestone blocks and field stones from wall stone bases.

Micromorphology analysis supplemented field evidence in order to reconstruct formation processes and to support archaeological interpretation about socio-cultural practices related with abandonment of building SA VI.

In thin section KVP14.2, from the north area of the building, close to the entrance, the last occupation floor of Phase A1, unit 681c, is overlaid by a 2 cm thick layer of pale brown sandy clay loam, mixed with limestone inclusions and orange silty clay loam aggregates, unit 643 (deposit Type 12b), possibly deriving from degradation and collapse of internal wall plaster (Fig. 6.22 c) This layer is mixed with and covered by the upper deposit of field stones and limestone blocks from the collapsed wall stone bases [643].

In the southern section of the building, represented by thin-section KVP14.4, the same pale brown calcareous deposit (unit 685a), is mixed with and overlaid by >5 cm thick layer of orange sandy clay loam deposit, unit 685 b (deposit type 12 YY), originated from the erosion and collapse of wall bricks and possibly roofing structures, mixed with decomposed organic matter, possibly from collapsed wooden structure (deposit type 12b).

Occasional lenses of sandy clay loam deposit of charred matter mixed with ashes and building material debris have been observed in the mid-southern area of SA VI, as represented by thin section KVP14.1, unit 688, deposit Type 12a. The occurrence of this burnt lens in only one area of the building-unit and in the more surficial area of the destruction sequence, suggest that it possibly derive from occasional use of the structure, after its abandonment (Friesem et al. 2014a) and not from the burning of the upper wooden structures. The upper boundary of this unit is strongly turbated by faunal and floral activity and by the collapse of limestone blocks and field stones from wall stone bases [647], as also observed in the norther section of the building-unit.

The evidence presented hints at a possible natural degradation of the building structures after its abandonment, with the collapse of the internal wall coating followed by the erosion of mudbrick walls and possible roofing structures, and finally with the collapse of stone wall bases. The decay process was possibly accelerated by the deliberate destruction of the adjacent building-unit SA I and the collapse of the shared western wall.

6.7.7 Conclusion and interpretation

The architectonic, artefactual and depositional evidence analysed in building-unit SA VI indicate that the interior space was used as productive/working open-area during the early phase B, and possibly as reception space during the later Phase A, when the building-unit was turned into a closed roofed space. The hypothesis of architectural renovation of this building, with a possible shift to representative function, is supported by the occurrence of frequent episodes of floor construction. Spatial variations in the use of space have been observed both during phase B, with the separation of the western and eastern area of the building-unit by a different depth

of the floor level, and during Phase A with the occurrence of a variation in the depositional sequence between the norther entrance area and the southern area of the building-unit.

The different spatial layout of SA VI with the access located to the North, the diverse material assemblage, with a major occurrence of bowls and pouring vessels, possibly for consumption, and the total absence of big storage vessels, and the distinctive micro depositional-history of this space, which is characterised by many phases of construction and occupations, are representative of a diverse use of this building compared to that analysed in the other building-units of Area A. The possible shift from working to reception function may possibly reflect the socio-cultural improvement and increase in wealth at Erimi-LtP during the later Phase A, presumably sustained by an extra regional economic system, which favoured the creation of spaces of interactions and exchange at a supra-community level, as further discussed in Section 8.5.1.4.

6.8 Final remarks

In this Chapter, the building-units of Area A at Erimi-LtP have been examined in order to reconstruct the micro-history of these key-spaces, from the construction and use to the abandonment of the structures. The contextual evidence analysed provides a valid data-set to examine the socio-cultural dynamics and economic development at Middle Bronze Age Erimi-LtP, and to compare architectural and archaeological data at Erimi-LtP with those of other Early, Middle and Late Bronze Age Cypriot sites, in order to examine the formation and reproduction of new social identities, roles and relations and the increasing social complexity during the recent prehistory-early protohistory in Cyprus.

6.8.1 Construction

Access analysis coupled with the study of geometric and architectural characteristics of the built space revealed that the presumed productive area A was planned and constructed with an organic and regular layout. Open, semi-open spaces and building-units were carved into the bedrock floor in order to be parallel oriented and distributed into the built space, according to preferential routes and passageway. As illustrated in the access graphs, Area A shows a shallow spatial configuration, that encouraged easy movement between the spaces and integration between social agents (Cutting 2003; Fisher 2009a; 2011). This spatial organisation was possibly the result of a high collaboration between community members, and suggests a socio-economic organisation at supra-household level, as more widely discussed in Chapter 8 (Paz 2012).

While open and semi-open spaces were less enclosed by limitation structures and were designed to favour interaction among the community (and possibly extra-community) members, the roofed building-units were less permeable from the outside especially in the passage to the later Phase A, when the introduction of carefully dressed monolithic thresholds, enhanced the segregation between the inner space of building-units and the outdoor areas; the passage between the inside and outside space was even more reinforced by the construction of small annexes, which extended the liminal role of thresholds, functioning as hallways (Fisher 2009b).

6.8.2 Occupation and Use

The study of activities and use of space through the analysis of stratigraphic, artefactual micromorphological data of floors and occupation deposits, revealed interesting evidence about spatial and temporal variations in the use of space in Area A.

The analysis of distribution of fixed, semi-fixed and portable objects within roofed-units indicated that processing and storing activities were conducted in these buildings. However, the occurrence of prestigious and possible ritual objects, especially in building-unit SA III (see Figure 6.6), may suggest that public, representative occasions were possibly conducted in these structures, together with more common and utilitarian activities.

The analysis of floors revealed significant evidence for the reconstruction of past activities and use of space within building-units of Area A. The absence of prepared floors in open areas, based on field observations, is in contrast to that observed in the field and analysed using micromorphology in roofed areas, where the sequences studied comprise deliberately laid floors. Of further interest, 97% by number of the prepared surfaces in interior rooms, examined using micromorphology, were kept extremely clean. Where there are accumulations of occupation deposits between plaster floors they range in thickness from 600 μm to 2-3 cm; however, these represent just the 3% of the observed deposits in microstratigraphic sequences.

Within each sequence analysed there is a considerable spatial and contextual variation in the type and thickness of plaster floors and materials associated with them.

As illustrated in the cladistics diagram, Figure 6.26, floors are principal markers of the variation in the use of space within building-units in Area A. Sandy clay loam floor plasters were laid on multifunctional working spaces, as SA I and SA IIa, associated with working/storing/processing installations as basins, pits, hearths and benches, and different semi-fixed and portable objects as big storage vessels, jugs and juglets, bowls, spindle whorls and stone tools (see Fig. 6.25). Silty clay, silty clay loam floor plaster layers were more

frequently laid in entrance and reception spaces, as SA IIb and SA VI, as well as in possible working/ritual spaces as SA III, were common use objects were mixed with prestige vessel and ritual objects (Fig. 6.25). Thick layer of unfired sandy clay loam floor plaster was encountered only in one case, and was used to seal Phase B occupation deposit in building-unit SA VI, functioning as packing and floor at the same time. Limestone slabs floor was observed in the latest occupation phase A1 of building-unit SA VI, and was possibly constructed to mark the architectonic renovation and to improve the social representation of this building.

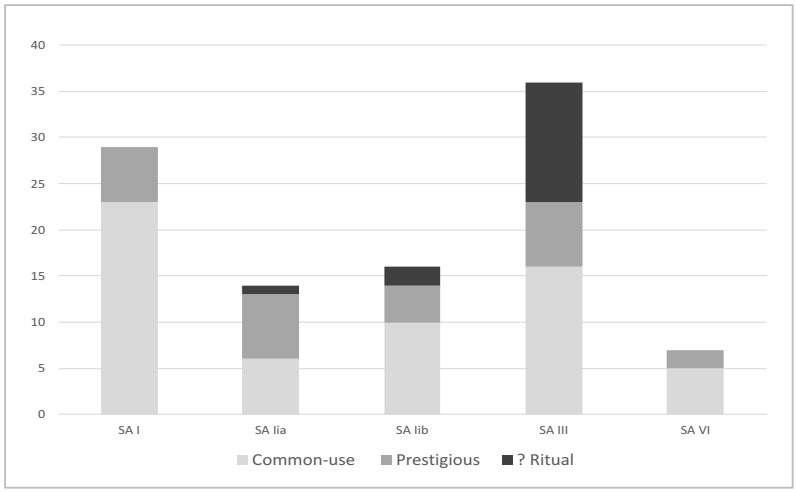


Figure 6.25 Bar chart showing the number of artefacts, which occur within each of the buildings analysed, during the late Phase A. Objects recovered and analysed have been divided into three categories: common-use objects, which includes undecorated vessels and stone tools; prestigious objects, which comprises decorated and imported vessels; and ritual objects which includes those objects that possibly have symbolic and ritual functions.

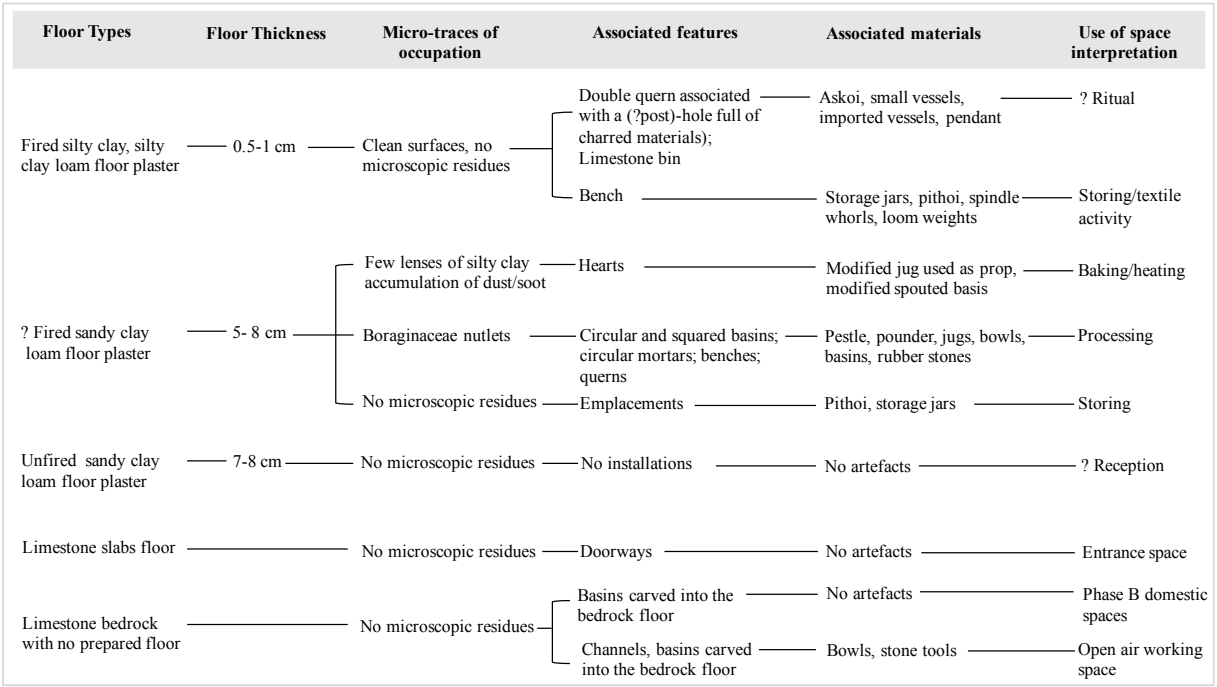


Figure 6.26 Cladistic diagram illustrating the interpretation of uses of space in order of floor type and thickness. The associations are indicated between floor types, the presence or absence occupation residues and the occurrence of specific architectural features and artefacts; these associations supported the identification of activities types carried out in the spaces analysed.

Temporal variations between the early Phase B and the later Phase A have been observed within buildings analysed. In the passage to the later Phase A most of the multifunctional units maintained their functions but became more specialised; this is particularly evident in the improvement of storage facilities observed both in SA I and SA IIa. Moreover, the analysis of architectural materials, indicated much greater elaboration of the interior places and features. At the same time, some of the working open spaces of phase B as SA IIb, WA V an and SA VI were turned into roofed buildings, with possible receptive and representative functions.

6.8.3 Abandonment dynamics.

The study of abandonment deposits through the integrated application of stratigraphic and microstratigraphic analyses revealed the occurrence of two distinct destruction processes. The first process refers to the gradual structural degradation, as observed in building-unit SA VI. This process, possibly accelerated by the more rapid destruction of adjacent buildings caused the slow burial of the structures and impacted on the preservation of the underlying deposits, which were less preserved and more strongly bioturbated.

The second process involves the fast destruction of building-structures, possibly caused by a fire event, which sealed completely the occupation surfaces and deposits and allowed good preservation of artefacts and micro remains. The occurrence of extended traces of burning in building-unit SA I and SA III mainly, led to suggest a possible deliberate fire, presumably associated with building closure rituals. This idea was principally supported by the archaeological evidence observed in SA III, where the occurrence of a particularly rich assemblage and the sealing of the last occupation deposit with stones and sediment, suggested a possible abandonment ritual and sustained the idea of deliberate conflagration, as part of ritual practice (Stevanovic 1997; Verhoeven 2002; Harrison 2004; 2008; Twiss *et al*. 2008). The assumption of ritual closure of representative buildings of Area A would support the hypothesis of a gradual and planned abandonment of this settlement area, as further discussed in Chapter 8 (Cameron 1991; La Motta and Schiffer 1999).

7. CONTEXTUAL ANALYSIS OF THE USE OF SPACE AT ERIMI-LAONIN TOU PORAKOU: the proposed residential area, Area B

7.1 Introduction

The aim of this chapter is to reconstruct the micro-history of the proposed residential area of the settlement of Erimi-LtP, Area B, throughout the life-history of the buildings, from the construction and use to the abandonment of the structures, to analyse similarities and possible differences in the use of space and related socio cultural practices between Area B and Area A, the proposed productive area, at the multiple dynamic scales of everyday life and longer term.

The same methodological approach applied to Area A is used in the analysis of Area B in order to produce a homogeneous data-set, with which to compare the two areas of the settlement. Syntax and geometric aspects of the built space are analysed first in order to study buildings structure, and pattern of movement within buildings and between buildings and outdoor spaces and to determine the nature and location of social interaction and reproduction. The resulting data-set is included in the Access graph, which represents the key syntactic and architectural properties of building units and open areas analysed in Area B (see Figure 7.3 and Table 7.1).

The nature and history of individual spaces is then approached, integrating macro evidence of number and form of fixed installations, semi-fixed element and portable objects with micro evidence of floors and occupation deposits (see Section 6.1). Archaeobotanical evidence, which are part of the data-set presented in Area A, are not included in this section as analysis of bioarchaeological residues recovered through flotation in open and roofed areas of Area B are still ongoing. Finally, a brief analysis of abandonment dynamics, on the basis of field evidence and macro-stratigraphic data, concludes each section analysed. The interdisciplinary data and contextualised results are presented by settlement area, spaces (open and roofed) and building-units.

Data recovered from Area B are more limited than those analysed in Area A, firstly as Area B was less extensively excavated than Area A (Area A: 900 m^2; Area B: 300 m^2), secondly because depositional sequences of Area B are poorly preserved due to strong bioturbation and soil downslope movement, as consequence of the placement of Area B on the back-slope of the hill. Alterations of depositional sequences restricted the analysis of the use of space within roofed buildings to only one context: Building-unit 2. Micromorphological analysis was conducted to study construction materials through study of four blocks: mud-brick (KVP13.3),

earthen roofing material (KVP14.32), feature mortar (KVP13. 20) and floor plaster (KVP13.13).

The following sections examine geographically in turn: Area B open areas (7.3) then the interior space of Building-unit 2 (7.4), to signpost macro and micro evidence, which support the analysis of spatial and temporal variations in architectural practices, activities and use of space.

7.2 Area B, the proposed residential area: an overview.

The probable residential area of the settlement, Area B, was constructed on the back-south slope of the hill with a different plan to that observed in Area A (Fig. 7.1). Roofed-units were distributed around big open courtyards, as represented by access graph Figure 7.3 and illustrated in the schematic plan Figure 7.2. Buildings in Area B were organised with a more agglutinative layout than building-units in Area A, which were constructed parallel each other and planned with a more regular layout (see Section 6.2).

The predominant deposits evident in the field in open areas comprise brown sandy clay loam topsoil, >50 cm thick. By contrast the roofed units were carved into the bedrock floor to a depth of 50-70 cm. Floor sequences in interior spaces tend to be 15cm to 20 cm deep.

The sequences analysed in Area B are more strongly altered by erosion and faunal and floral activities, a phenomenon, which is stronger in Area B than in Area A, due to the occurrence of carbos tree, whose roots reach the deeper strata of depositional sequences, and whose shadow offer refrigeration to many faunal species that burrow in their proximity.

Despite the sparsity of data from stratigraphic sequences it was possible to identify marked differences between depositional sequences in open areas and within buildings and also to analyse and identify the most significant differences between sequences in Area B and Area A.

Open-areas were built directly on the natural surficial bedrock floor, and were not carved into the bedrock floor unlike interior units as illustrated in the stratigraphic columns Figure 7.4. Thereby, deposits in open areas are more elevated and less enclosed than interior sequences and are more exposed and subjected to erosion and soil movement by natural agents, as also observed in Area A. The predominant deposits evident in the field in open areas comprise brown sandy clay loam topsoil >60 cm thick.

By contrast interior building-units were carved into the bedrock floor to a depth of 50-70 cm. Floor sequences in interior space tend to be only 15 cm deep.

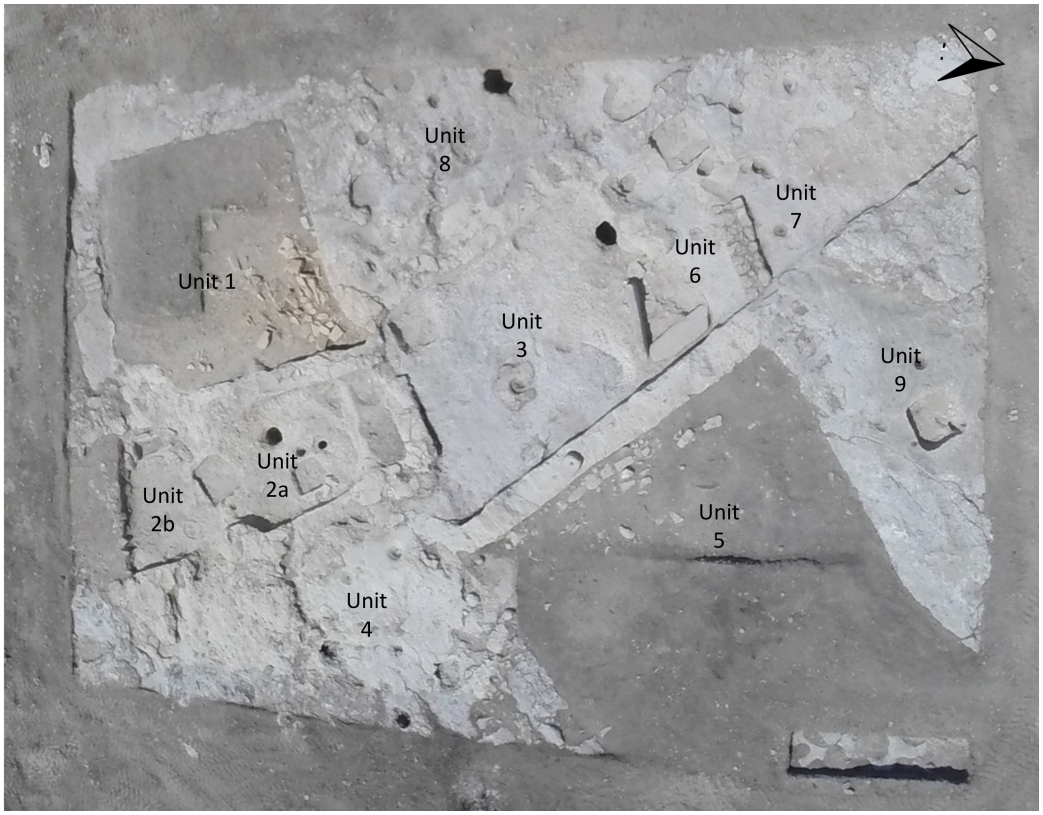


Figure 7.1 Aerial plan of Area B with indication of open-areas (Unit 4, 8, 9) and building-units (Unit 1, 2, 3, 5, 6, 7).

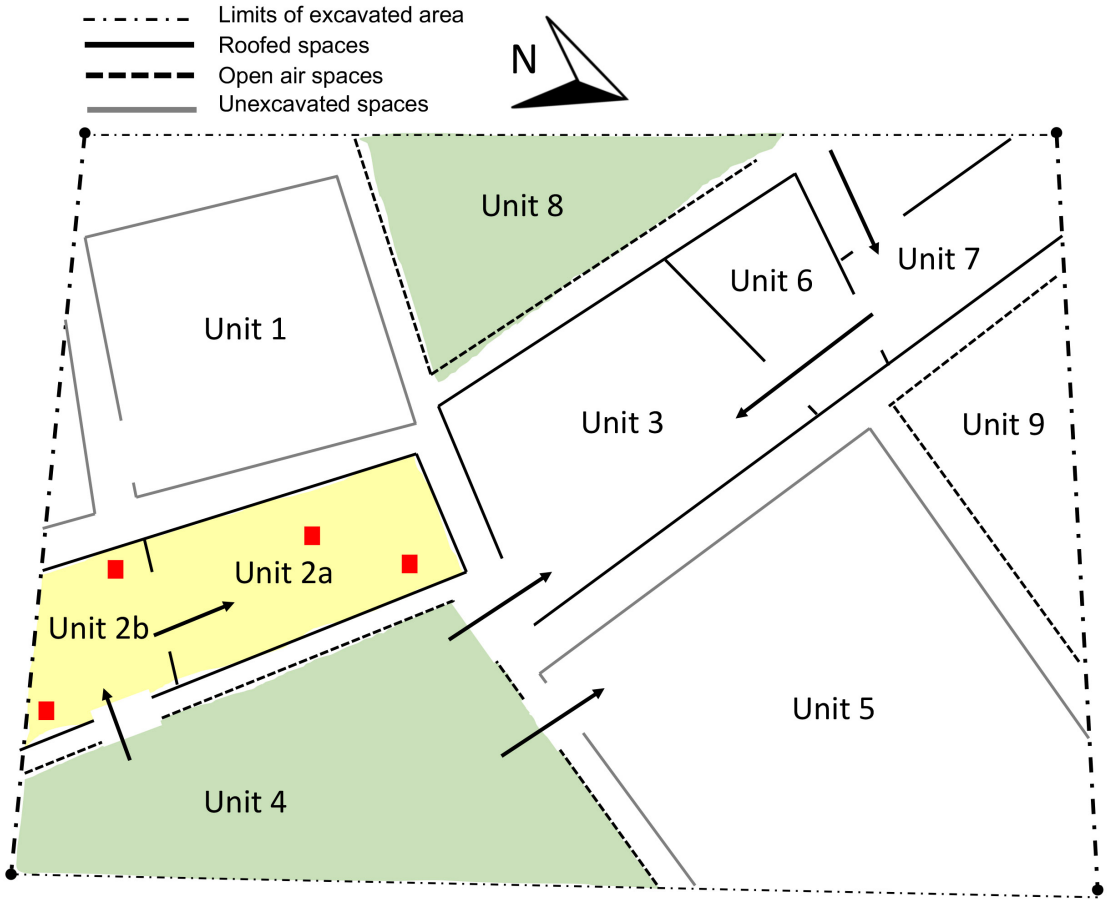


Figure 7.2 Schematic plan of Area B. Building-unit analysed is highlighted in yellow, open-spaces in green. Red squares show location of micromorphological blocks.

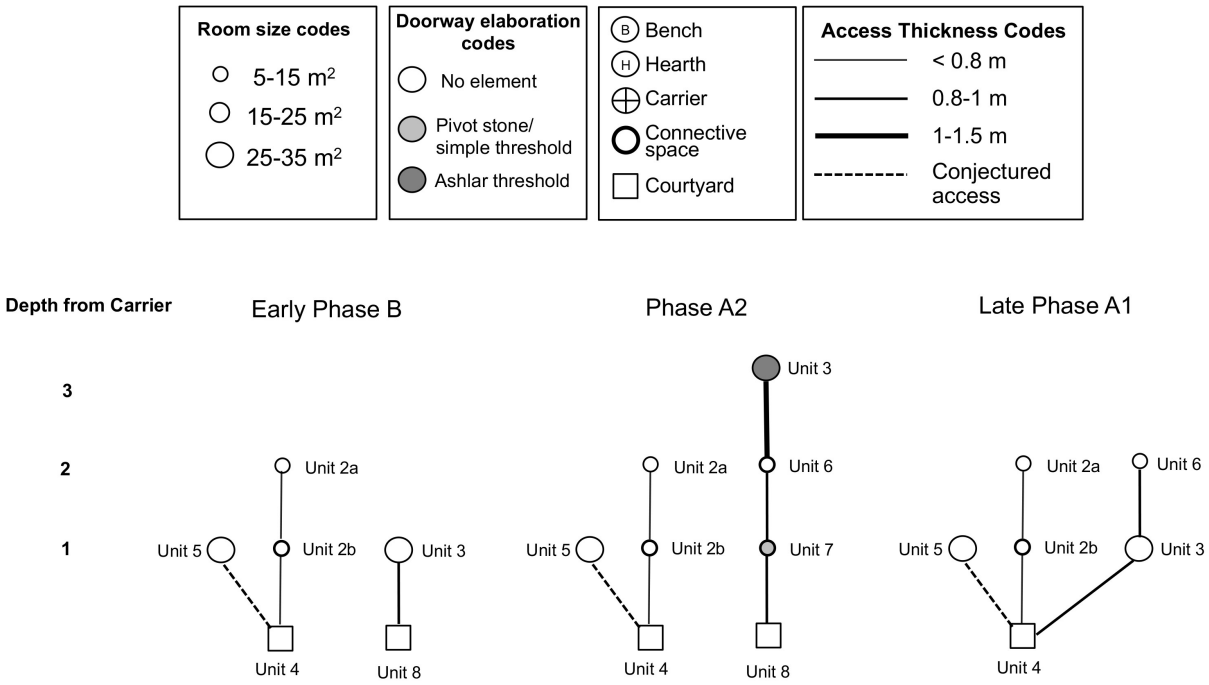


Figure 7.3 Justified Access graph of Area B during early phase B, phase A2 and late phase A1. The graph is coded for room size, doorways elaboration and access thickness. Data illustrated are only relative to areas completely investigated and analysed.

Table 7.1 Area B, Phase A2 ranking of key syntactic and architectural properties of contexts analysed. Control Value (CV), Relative Asymmetry (RA), Mean Depth (MD) and Convexity values were calculated according to Hillier and Hanson (1984, 143-175) and Fisher (2009, 440-446). Doorway elaboration was calculated on the basis of following ranking: no element = low; pivot stone/simple threshold = medium; ashlar threshold = high.

Control value			**Relative Asymmetry**				**Convexity**		**Doorway elaboration**	
Context	CV	Rank	Context	RA	MD	Rank	Context	Score	Context	Rank
Unit 4	2	High	Unit 8	1.084	3.71	High	Unit 2a	0.58	Unit 2a	Low
Unit 8	1.5	Medium	Unit 2a	0.968	3.42	Medium	Unit 2b	0.717	Unit 2b	Low
Unit 7	1.5	Medium	Unit 5	0.74	2.85	Medium	Unit 3	0.783	Unit 3	Med/high
Unit 6	1	Medium	Unit 7	0.72	2.8	Medium	Unit 4	0.86	Unit 4	Low
Unit 3	0.8	Low	Unit 2b	0.6	2.5	Low	Unit 5	0.921	Unit 5	Low
Unit 2b	0.8	Low	Unit 6	0.48	2.2	Low	Unit 6	3.63	Unit 6	Medium
Unit 2a	0.5	Low	Unit 3	0.4	2	Low	Unit 7	2.68	Unit 7	Medium
Unit 5	0.3	Low	Unit 4	0.3	1.75	Low	Unit 8	-	Unit 8	Low

7.3 Area B. Open and semi-open areas: spatial layout, features, artefacts and floors.

Open areas were constructed on the natural surficial bedrock floor as squared spaces enclosed by building-units (Figs. 7.1 and 7.2). The orientation and spatial configuration of these open-areas follow that of open spaces in Area A, suggesting a regularised planning in construction of individual building-units and areas of the settlement (see Section 8.4.3.1).

Two big open-areas have been identified on south-east and north-western section of Area B, respectively open-unit 4 (45 m^2, currently exposed) and open-unit 8 (20 m^2, currently exposed); a third open-area has been partially exposed on the northern section, open-unit 9, but not analysed yet. These open-areas were constructed and organised in order to be connected to one or more building-units as illustrated in the Access graph (Fig. 7.3). Access analysis indicates that open spaces were organised in order to favour interaction between agents living and using these spaces, in contrast with building-units, which were arranged as more private spaces, as illustrated in the access graph, Figure 7.3. The layout observed in Area B, with buildings clustered around a courtyard, is analogous to the spatial organisation of other Early and Middle Bronze Age household contexts, notably Marki-*Alonia* (Frankel and Webb 1996; 2006) and Alambra-*Mouttes* (Coleman *et al*. 1996) (see Section 8.4.3.1).

Many different working installations were constructed in these open-areas, including squared and circular basins, circular storage and refuse pits and mortars carved into the bedrock floor and coated with a hard, pale brown sandy clay loam plaster, as analysed in the field. Artefacts *in situ* are almost absent, except for fragmentary materials pertaining to functional ceramic objects as jugs and bowls.

To date, no deliberate prepared floor has yet been identified in open areas, as also observed in open and semi-open areas of Area A. The absence of prepared floors in open areas, based on field observations, is in contrast to that observed in the field within Building-unit 2, where the sequences studied comprise deliberately laid floors, as presented in Section 7.4 and illustrated by stratigraphic columns Fig. 7.4.

The occurrence of working and storage installations in association with functional and common use vessels and the absence of prepared floors and limitation structures suggest that open-areas were possibly used as courtyards, where possibly communal activities were carried out (Swiny 1989).

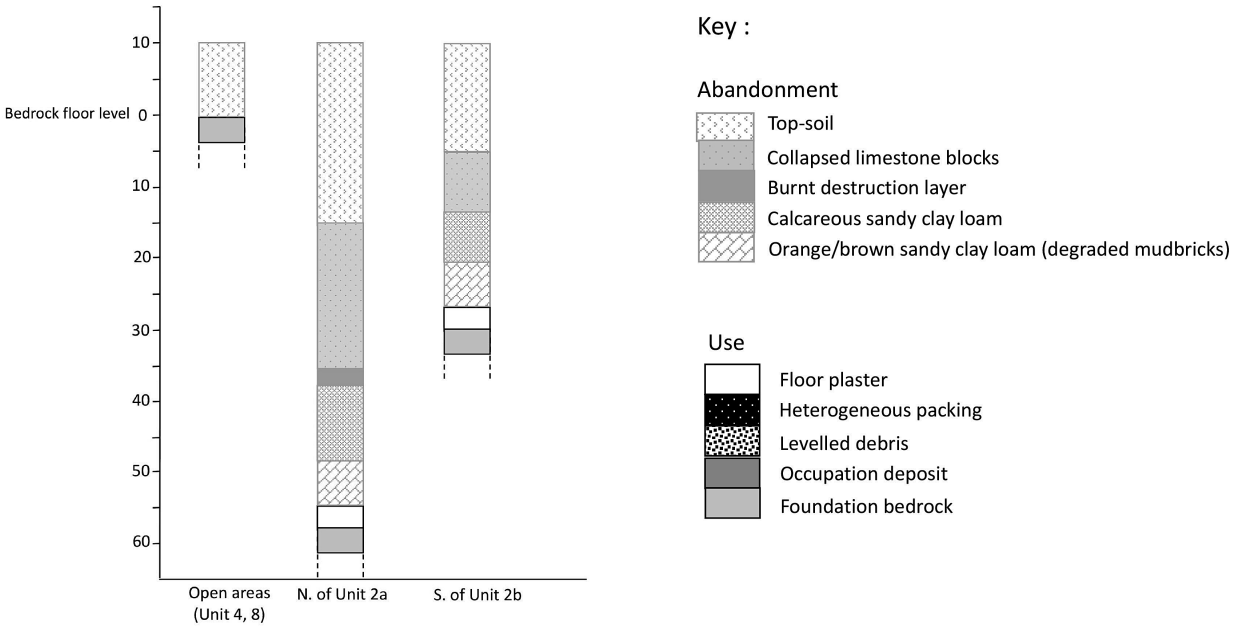


Figure 7.4 Stratigraphic columns illustrating the type, thickness and frequency of floors and destruction layers in open-areas and within Building-unit 2a and 2b as analysed in the field.

7.4 Area B. Building-unit 2: spatial layout and construction

Building-unit 2, is one of the two completely excavated and analysed building-units of the presumed residential area of the settlement, and was constructed in the south-eastern portion of Area B. It measures 22,5 m^2, 7.5 x 3 m. The building-unit was originally carved approximately 60-40 cm deep, into the bedrock floor in a roughly rectangular shape, with a North-West, South-East orientation. A <50 cm wide edge of the original surface of foundation bedrock of marly miocene limestone, into which interior spaces were carved (deposit Type 1) was left *in-situ* and used as an elevated stable base, on which to build the standing walls, as also observed in Area A (Section 6.4).

Access analysis indicates that Building-unit 2 was organised in order to be permeable from the outside, with a direct access from the open courtyard, Unit 4. The inner space of the building-unit was divided in two rooms, 2b (the southernmost one) and 2a (the northernmost one), by a partition wall. Room 2b was directly connected to the courtyard through an access of 60 cm wide carved into the eastern bedrock base of the structure; while room 2a was only accessible through room 2b and not in relation with the courtyard (see Fig 7.2). This layout created a specific syntax, characterised by one room, 2b, more permeable from the outside, which possibly filtered the access to the inner room 2a, which was less accessible and more private, as evidenced by the analysis of syntactic and architectural properties of the built space (see access graph Fig.7.3 and Table 7.1).

The access to Building-unit 2 was not elaborated, nor embellished with architectonic elements such as pivot stones and monolithic thresholds. The passage from the roofed to the open space was simply created by carving into the limestone foundation bedrock base, as observed in building-unit SA IIa in Area A, during the early Phase B. In contrast with the regular pattern in access placement in structures of Area A, the building-units of Area B, do not show any recurrent pattern in access placement, suggesting that entrances were arranged, according to individual routes/passageways between buildings and courtyards (see Fig. 7.2; Fisher 2009a; Parker Pearson and Richards 1994, 1-34).

Building-units 2 has two distinct phases of occupation, each marked by the construction of a series of architectural installations and occupation surfaces, as represented in the stratigraphic graph Table 7.2. This table summarises the evidence recovered and analysed in Building-unit 2 from the basal entry and construction of the structures to building use and abandonment. Interpretation of possible uses and functions of buildings and associated macro and micro materials are presented on the basis of key indicators from comparative ethnographic and microstratigraphic research, reported in Table 6.5 (Chapter 6).

Table 7.2. Stratigraphic sequence of deposits analysed in Building-unit 2. Abbreviations and codes: D. = doorway, followed by filed no.; Ft.= architectural installation, followed by field no.; W.= wall, followed by filed no.; [number] = stratigraphic number given to deposit on field. Micromorphological data are presented in *italics* and are identified by deposit Type (according to the classification presented in Chapter 4).

Field stratigraphy	Interpretation	Macro and micro materials
Post-abandonment	- Top soil:	Natural brown, sandy clay loam [8, 9] turbated by faunal and floral activity and organic decay and reworked by erosion and down-slope movement.
Abandonment	- Destruction:	Collapsed wall in limestone blocks mixed to plaster and mudbricks debris [35, 36, 64, 84]. Orange, silty clay loam and mudbricks debris [65].
Use - Phase A	-Cooking	Fixed element: Rectangular hearth made of limestone slabs and silty clay mortar Semi-fixed element. 1Small dolerite rubber stone 1 Mealing bin (fragmentary) Portable objects: 1 ceramic hob 1 fragmentary cooking pot
	-Storage	Fixed elements: Bench in plaster with two circular basins (Ft. 1) Portable objects: 1 RP storage jar
Construction - Phase A	*- Floor*	*Pale brown, silty clay loam* ***Plaster floor*** *([71],Type 9c)*
Use – Phase B	- Storage/processing	Fixed elements: Squared basins carved into the bedrock floor (Fts.14, 15, 17); Circular basins/pits carved into the bedrock floor (Fts 12, 13) Bench in plaster with two circular basins Ft. 1
Construction – Phase B	- Floor	**Bedrock floor** used as floor [10]

7.4.1 Wall construction and materials

The upper sections of walls on the limestone foundation base, were constructed of four up to seven courses of limestone blocks and slabs (average dimension: width 20-30 cm; height 8-10 cm) bound with yellow silty clay loam mortar. The Southern walls of the unit were constructed with more courses of limestone blocks and slabs than the Norther ones. The use of more courses of limestone blocks and slabs on the southern wall of the building may reflects the functional choice to protect the more exposed side of the building against natural agents, in particular from winds and saltiness from the South sea-side. In addition, the strengthening of the south wall of Building-unit 2, may also have responded to static requirements, deriving from the fact that the entire Area B was built on the hill slope. As consequence, the northern foundation base of the building-unit was approximately >20 cm higher than the southern one. For this reason, the southern walls needed to be compensated with more courses in stone blocks, to create a solid base where to build the upper wall structure in mudbricks, as illustrated in Fig. 7.5 (Wright 1985, 380-381).

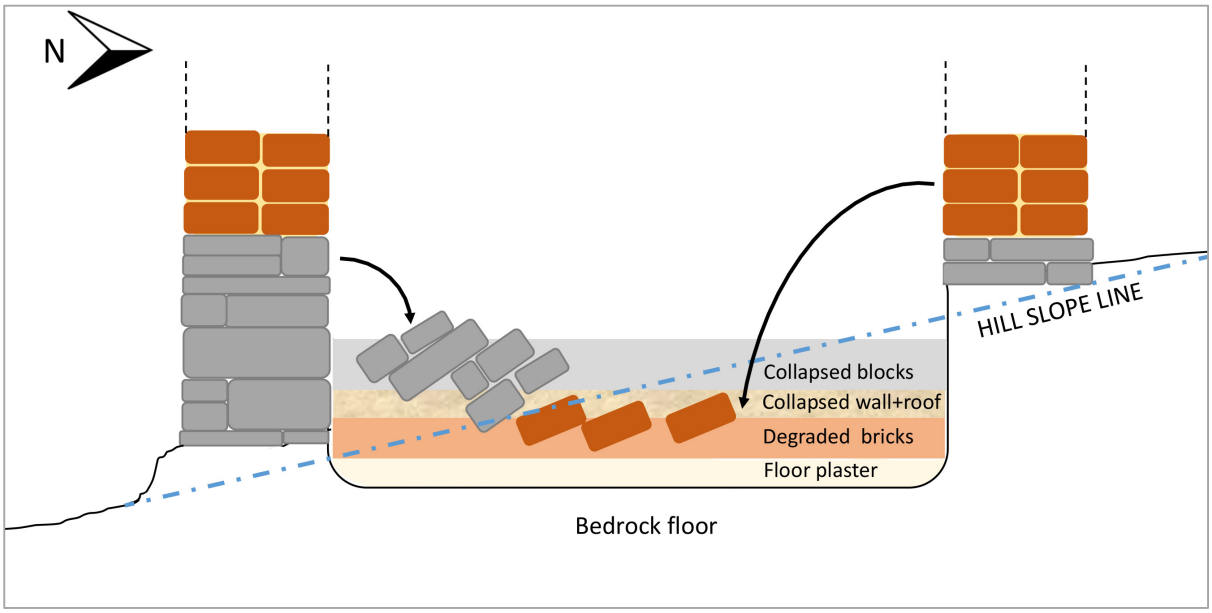


Figure 7.5 Schematic graph illustrating the building technique adopted in the construction of buildings in Area B on the back slope of the hill. The graph also represents the general depositional sequence of floors and collapsed materials analysed in roofed-unit 2 of Area B.

Very few preserved mudbricks were found in the collapsed wall structure of Building-unit 2; only one was partially intact. Its measures are approximately similar to that of smaller bricks from Area A (deposit Type 2a), but smaller than the standard measures recorded in other Early and Middle Bronze age Cypriot sites as Marki-*Alonia* and Alambra-*Mouttes* (proportion: 2:1:1; Philokyprou 1998, 181-184). Comparative micromophological and XRF analysis of mudbrick

KVP13.3 and local natural sediments revealed that a red silty clay loam from terra rossa/fusca deposits (deposit Type 2a) was selected for the construction of the eastern mudbrick wall.

Only one fragment of earthen building material, possibly from roofing structures, has been recovered from the south-wall collapsed structure. The fragment of 3 cm thick shows three finger prints, possibly left when the earthen material was applied. The small size of the finger impressions, led to presume that these may pertain to a woman or a child (Bombardieri *et al.* 2017a); a minor yet significant data that shed light on social organisation and gender related re-distribution of building activities among the community members of Erimi-LtP (see Section 8.4.2.2; Kramer 1979; 1982; Frankel and Webb 2012b; Bolger 2003, 51-82).

Micromorphological analysis conducted on thin-section KVP14.32 indicates that the earthen construction material was manufacture using a red/brown sandy clay laom, possibly from terra fusca deposit, as confirmed by XRF analysis (deposit Type 3; Fig. 7.6 g). The source material is similar to that used in red mud-bricks analysed in Area B and Area A, but it is richer in sands, which was possibly added as inorganic temper to the raw material to obtain a malleable material easily applicable by hands, as also analysed in ceramic shards of local Red and Drab polished productions (Fig. 7.6 e, f; see Section 5.3.1).

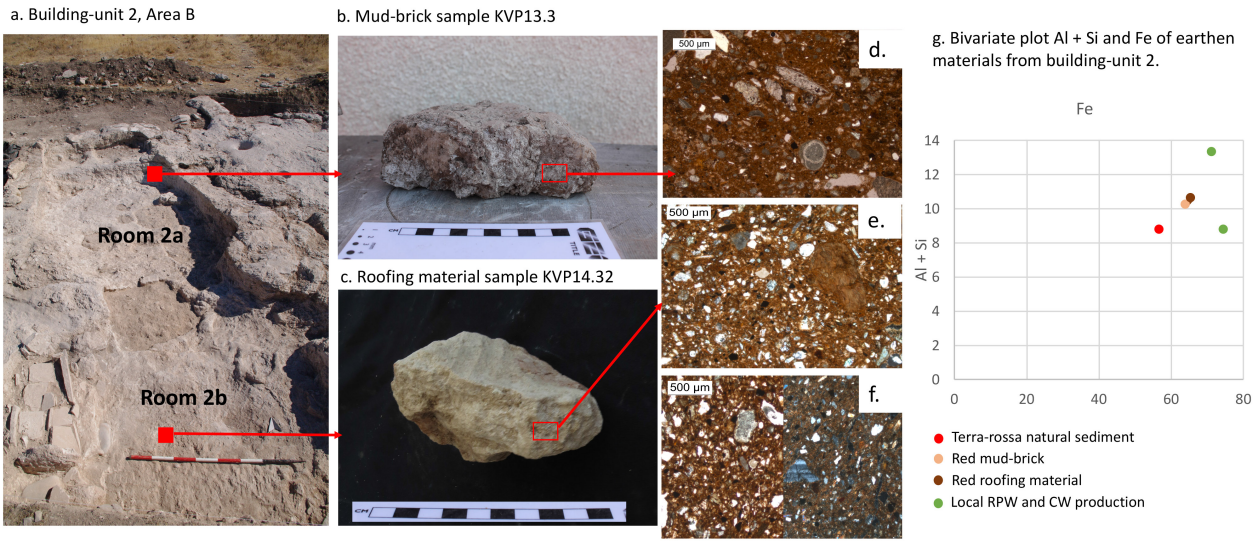


Figure 7.6 a) Building unit-2 with rooms 2a and 2b. b) Partially preserved mudbrick sample KVP13.3 recovered from the collapsed north-eastern wall of room 2a. c)Earthen construction material sample KVP14.32, possibly from roofing structures, characterised by three fingers print, from the destruction deposit on the southern limit of room 2b. d) Photomicrograph of red mudbrick sample KVP13.3 characterised by a red sandy clay loam, PPL. e) Photomicrograph of earthen construction material KVP14.32 characterised by a red sandy clay loam, richer in quartz sand (>15%) compared to mud-brick KVP13.3(5%), PPL f) Photomicrograph of sample KVP13.26, of local Drab Polished ceramic production, characterised by similar percentage of quartz sand than that observed in earthen construction material KVP13.32. g) Bivariate plot of Al+Si and Fe elements in mud-brick sample KVP13.3, earthen construction material KVP14.32, drab polished and course ware local ceramic productions, KVP13.26 and KVP14.35, and terra rossa local natural sediment, KVP16.8. The plot show similar amount in Al, Si and Fe in the samples analysed, hence to confirm the idea about the use of local terra-rossa in the manufacture of red mud-brick and earthen construction material from Area B.

7.4.2 Building-unit 2, Early Phase B: Architectural installations and artefacts.

In the early occupation Phase B, the space of the building-unit was carved in order to be organised in two distinct rooms, 2b on the southern side and 2a on the northern side. These two rooms, however, were not separated each other by partition walls but just divided by a narrowing of the foundation bedrock base. The passage from a room to the other was not filtered by architectural elements; nevertheless, the width of entranceway was limited by the construction of a fixed squared basin carved into the bedrock floor and placed in between the two rooms, Ft. 17 (see Fig. 7.8). The occurrence of this working installation impacted on the internal circulation within the building, by restricting the passage from room 2b to 2a to a width of 60 cm, the minimum standard for an internal passage according to Fisher (2007; 2009a).

The internal space of the building-unit was furnished with a series of fixed installations directly carved into the foundation bedrock floor. Room 2b, in direct connection with Courtyard 4, was characterised by only one squared basin (Ft. 17; Dimension: 1.05 x1.06 m; Depth: 20 cm), placed in the passage between the two rooms and presumably functional to processing activities (Fig. 7.8). The almost complete absence of installations in this room, during the early occupation Phase B, is in contrast with the density of fixed installation in rooms 2a. On the northernmost section of room 2a a bench directly shaped into the limestone bedrock and equipped with two large shallow and plastered circular basins (Ft. 1; Bench dimension: 2.4 x 1 m; Basin diameter: 0.7 -1 m; depth: 20 cm) as well as one squared and two circular basins (Ft. 14; Dimension: 86 x 74 cm; Depth: 21cm; Ft. 12, 13; Diameter:23-25 cm; Depth: 30-50 cm respectively) were possibly functional to processing activities. On the western side, a deep circular installation carved into the bedrock floor (Ft. 15; diameter: 70 cm; depth: 66 cm), was presumably used as storage pit. Its limited capacity, especially if compared with similar fixed and semi fixed storage installations from Area A (both pits and pithoi), may be representative of smaller-scale production, possibly restricted to subsistence goods (Frankel and Webb 2006).

The complete absence of artefacts both in room 2b and 2a pertaining to the early Phase B may be indicative of continuity in occupation within Building-unit 2, between the early Phase B and the later Phase A (La Motta and Schiffer 1999).

7.4.3 Building-unit 2, Early Phase B: Floors and occupation deposits

The foundation bedrock ([10], deposit Type 1) was used directly as floor during the early Phase B. The lack of prepared floor may suggest that this building-unit was used as working space during the earlier Phase B, according also to evidence analysed in open and semi-open areas and building-units of area A and summarised in the cladistic diagram Fig. 6.26 (Chapter 6).

However, while the lack of prepared floor in area A is typical of open and semi-open working areas, the absence of plaster floor within Building-unit 2 in Area B, may possibly indicate a limited effort in enhancing the architectonic elaboration and representation of the building, as more widely discussed in Section 7.5.

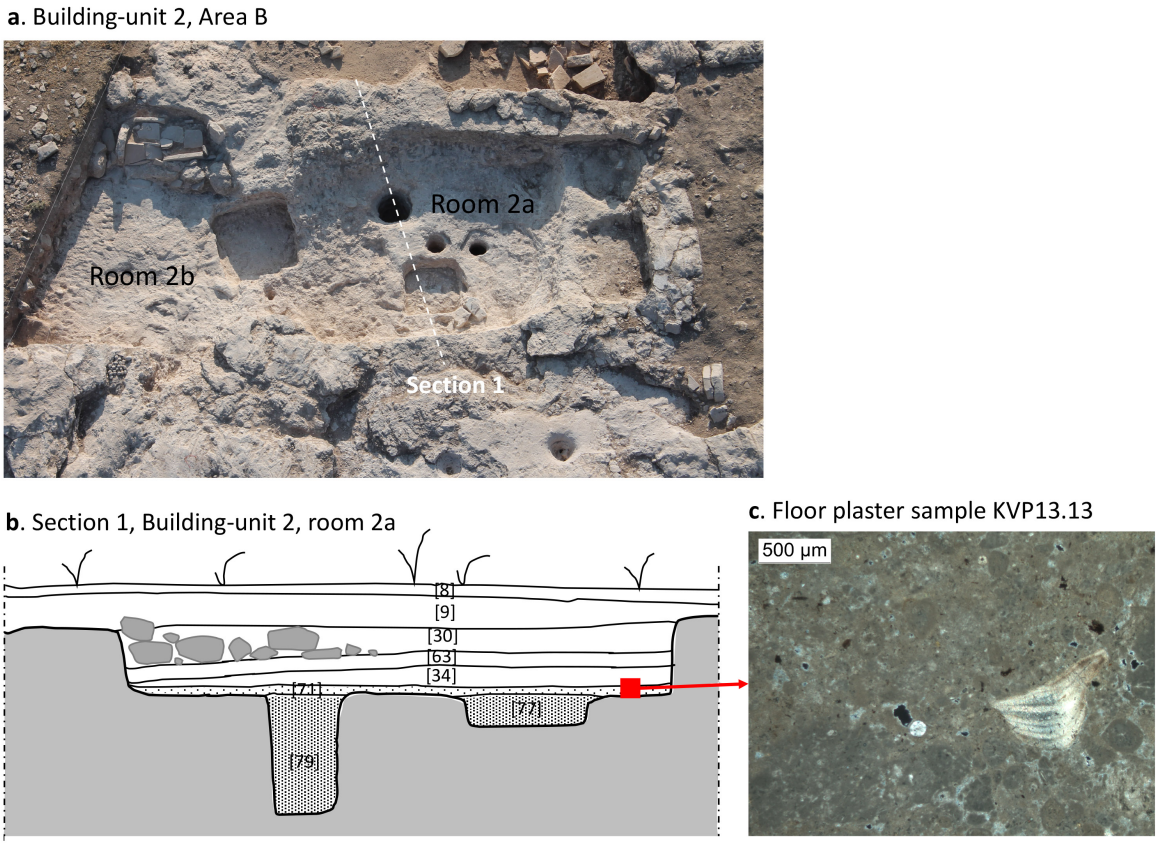


Figure 7.7 Microstratigraphy of floors in building-unit 2. a) Aerial photo of building-unit 2; the white line indicates the placement of section 1. b) Section 1 with the sequence of floors and deposits, as analysed in the field; the red square indicates the location of floor plaster sample collected, KVP13.13. c) Photomicrograph of floor plaster sample KVP13.13, pertaining to the later Phase A. The occurrence of calcite micro aggregates and round micro-pores and the presence of altered bioclasts (on the right) suggest that this plaster was possibly made with fired calcite; XPL.

7.4.4 Building-unit 2, Late Phase A: Architectural installations and artefacts

In the late Phase A, the internal space of Building-unit 2 was reorganised with the possible introduction of a partition wall in limestone blocks and plaster, which marked the segregation of room 2b from room 2a (see Fig. 7.8)

The spatial renovation of Building-unit 2 during this phase, is marked by the different arrangement of architectural installations within the two rooms. Working activities that were principally conducted in room 2a during the early occupation phase B, were moved in room 2b.

Room 2b acquired new functions, as suggested by the construction of a rectangular oven in regular limestone slabs and yellow silty clay mortar, placed on the north-west side of the room (Ft. 11; Dimension: 1.30 x 0.6 x 0.3 m). The association of the limestone oven with a deposit of burnt silty clay loam mixed with charred flecks and ashes, as observed in the field, and the occurrence of two RP jug necks at the bottom of the oven, which were possibly used as fume pipe, make this installation similar to the oven introduced during Phase A in building-unit SA I, in Area A. The presence of a hob, found in proximity of the limestone oven validates the idea that firing/cooking activities were carried out in room 2b during the late occupation phase A. The occurrence of a small dolerite rubber stone very closed to the oven, indicates that processing activities were also conducted in room 2b, and strengthen the idea of this as the productive space of Building-unit 2 during the late Phase A.

The change in use and activities within rooms 2b and 2a was possibly functional to the new syntax of Building-unit 2, with room 2b functioning as productive space, where interaction was fostered by the easy communication with the open courtyard, and with room 2a as more private space possibly used for cleaner activities.

The very few materials recovered from room 2b are associated with cooking/storing activities and may be considered de facto refuses of common use vessels, as a fragmentary cooking pot, a mealing bin and a fragmentary RP storage jar.

7.4.5 Building-unit 2, Late Phase A: Floors and occupation deposits.

The new occupation phase A is marked by the construction of a <1 cm thick layer of pale brown, calcareous fine sandy clay loam floor plaster, which was laid on the entire space of the building-unit [71]. Before its construction, the fixed installations carved into the bedrock floor, which were in use during the earlier Phase B, were infilled with a brown sandy clay loam, possibly from discarded inorganic material. The plaster floor was laid without any floor preparation, as also observed in Building-unit SA IIb of Area A.

Micromorphological analysis on sample KVP13.13 revealed that the pale brown fine sand clay loam floor plaster was possibly produced using fired lime (deposit Type 9c), on the basis of occurrence of round micro-pores from evaporation of water content during setting, the presence of calcitic micro-aggregates and the absence of vegetal temper (Fig. 7.7 c; Matthews et. al 2013; Matthews 2005b, 19.10). However, FTIR analysis conducted on bulk sub-sample did not provide any definitive result about origin and manufacture of this plaster type, possibly as consequence of post-dispositional calcite formation, which altered the composition of the archaeological material (see Section 5.3.3).

Field analysis on the southern section of room 2b did not identify accumulation of possible occupation layers on the plaster floor of Phase A. However, the strong alterations of stratigraphic sequences by faunal and floral activity and erosion, precluded the collection of undisturbed micromorphological block and higher resolution analysis of possible micro residues of occupation pertaining to the use of Building-unit 2 during the late Phase A.

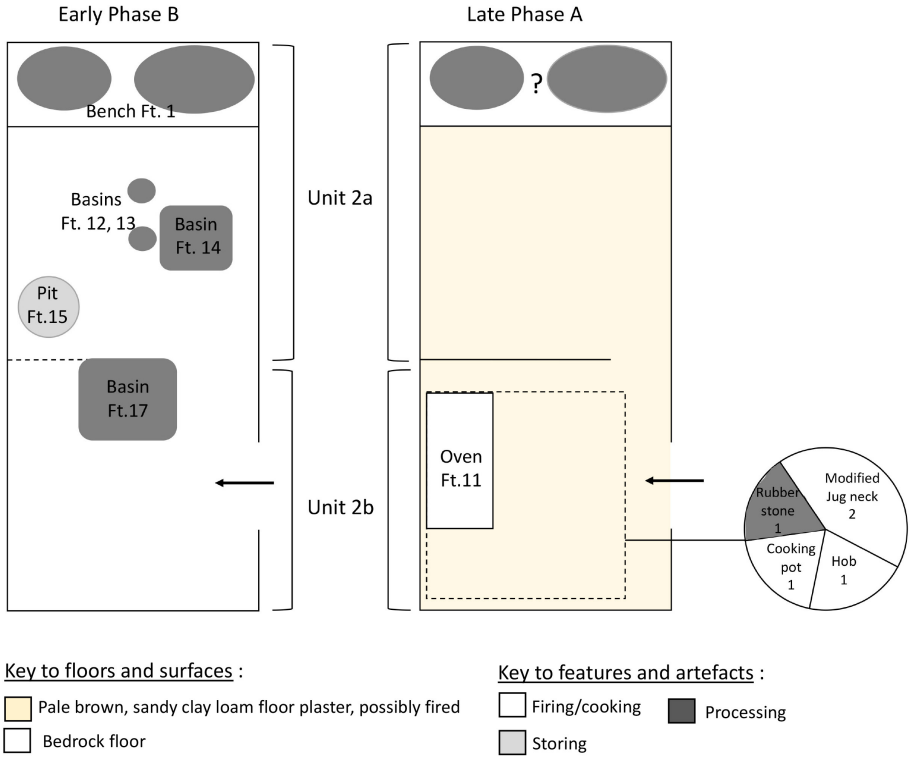


Figure 7.8 Variation in spatial organisation in unit 2a and 2b between the early Phase B and the later Phase A. The pie chart shows the distribution and occurrence of portable objects according to activities they are related to.

7.4.6 Building-unit 2: Abandonment process

The evidence related with the abandonment levels in Building-unit 2 are sparse due to erosion and downslope movement of upper layers. Both in room 2b and 2a, the floor plaster of phase A is overlain by a 5-6 cm thick layer of orange sandy clay loam from disaggregated mudbricks [65, 84], by 10 cm thick layer of pale brown calcareous sandy clay loam possibly from walls and roofing structures [66, 34] and by > 20 cm thick layers of limestone blocks and medium-big size field stones mixed with lumps of plaster [36, 63], from the collapse of stone wall bases, which particularly occur around the southern and eastern limits of the structure.

The occurrence of a small lens of burnt sediment mixed to ashes [43] under the layer of collapsed stone, in the north section of room 2a, may possibly be indicative of occasional use of fire after the settlement abandonment (Friesem *et al*. 2014b). On the basis of the evidence analysed in the field it is possible to suggest that the building structures decayed gradually. The

destruction of mudbrick walls and roofing structures possibly accelerated the collapse of stone wall masonry, as also observed in Building-unit SA VI in Area A.

The sparse occurrence of artefacts on the occupation floor of the late Phase A, especially if compared with the rich assemblages analysed in Area A (Fig. 7.9), may be attributed to two different agents of natural and socio-cultural origin. First, the placement of building unit on the hill slope possibly caused the loss of materials, which were down-slope transported by wind and water. Second, the selections of re-usable materials and personal objects, as consequence of a planned abandonment, presumably resulted in the occurrence of only fragmentary/discarded materials on the floor of late Phase A, possibly those materials that could not be cured (La Motta and Schiffer 1999).

7.4.7 Conclusion and interpretation

Data analysed in Building-unit 2 evidenced important characteristics in support of reconstruction of activities and use of space within buildings of Area B.

The space of Building-unit 2 was renovated and transformed between the earlier and later use of the building. The re-organisation of inner space with the pronounced segregation of room 2a and 2b, the subsequent construction of a more private room, 2a, less accessible from the outdoor space, and the introduction of a floor plaster during the later Phase A, may be interpreted as evidence of an increased organisation of the built space in this area, as well as of an improvement in building role and representation.

Spatial and temporal variation in the use of space within this building-unit are very pronounced as attested by the different use of room 2a and 2b during the early Phase B and the later Phase A. The construction of an oven in room 2b during the later Phase A marks the transformation in use of room 2b; the introduction of this new fixed element is particularly remarkable especially considering the lack of cooking/firing installations within Building-unit 2 during the earlier occupation phase.

All these elements are extremely important in the reconstruction of history and function of this area of the settlement and are better characterised if compared with data analysed in Area A, as discussed in Section 7.5.

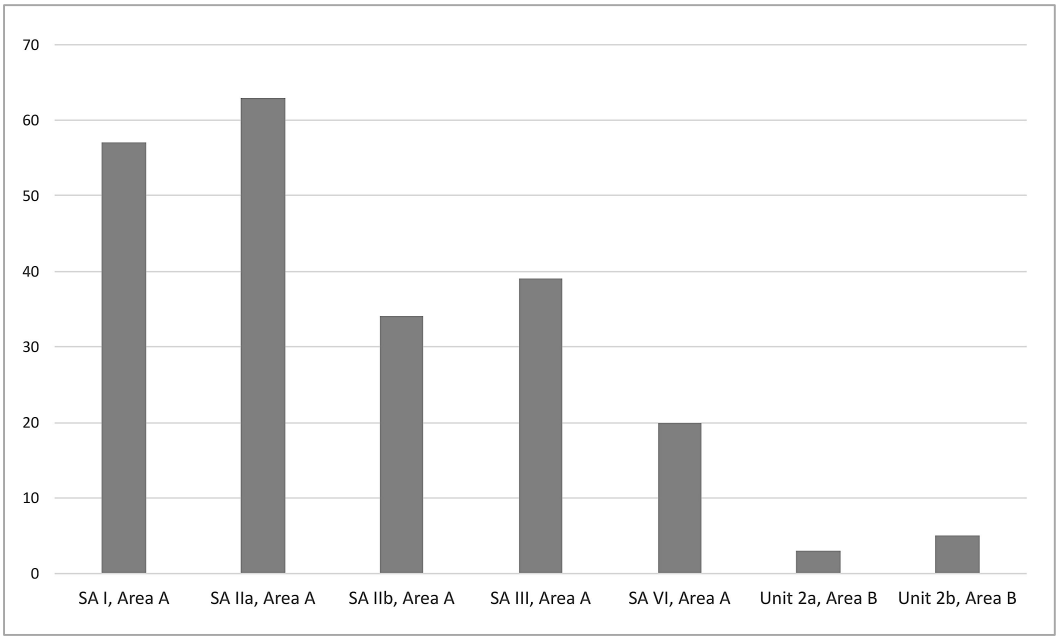


Figure 7.9 Graphs showing the number of portable objects recovered on the floor plaster of Phase A within building-units in Area A and B. The amount calculated does not include sporadic ceramic sherds.

7.5 Final remarks

7.5.1 Construction

Syntactic, geometric and architectonic data analysed in this chapter indicate marked difference in spatial organisation between buildings of Area B and buildings of Area A. The organisation of open areas and interior buildings in Area B reflects the spatial layout observed in other prehistoric sites in Cyprus, in particular Marki-*Alonia* (Frankel and Webb 1996; 2006) and Sotira-*Kaminoudhia* (Swiny et. al. 2003), with open, large courtyard functional to one or more building-units (Swiny 1989; Webb 2009; see Section 8.4.3.1). In Area A, instead, courtyards functioned as open communal spaces, not in relation with one or more than one building-unit. The assumption about different uses and roles of buildings of Area B compared to those of Area A, is further supported by the different layout of this area, which is characterised by an agglutinative plan and no recurring pattern in accesses and routes placement.

Despite these differences, buildings and spaces of Area B and A show similarities in orientation and building technique, which suggest that the settlement was built with an organic and structured plan; an evidence that indicates social cohesion and control over the level of single households (see Section 8.5.1.1; Frankel and Webb 2012).

7.5.2 Occupation and use

While open-areas were used for multifunctional working activities both in Area B and in Area A, building-units analysed in these two areas of the settlement show marked differences in use and concept of space.

The lack of prepared floors in Building-unit 2 during the early Phase B and the limited storage capacity of this space compared to multiple floor plaster layers and larger storage installations of building-units in Area A may presumably be representative of different functions, roles and representation of buildings in Area B and in Area A. These evidence, together with the low architectural elaboration observed in Building-unit 2, compared to the 'ashlar' architecture of many buildings of Area A, may indicate that functionality was preferred to elaboration in this space. All these data may possibly sustain the idea of Building-unit 2 as more private space, where a single household group provided the necessary labour for the construction of their own space. In contrast with communal, public building, the construction of 'private' structures was possibly more subjected to limited availability of workforce, resources and time, that resulted in reduced efforts in construction practice and productions (Wright 1992)

7.5.3 Abandonment dynamics

In terms of abandonment practices, Building-unit 2 of Area B seems to reflect different practices than those observed in many buildings of Area A. While, in Building-unit SA I, SA II, SA III of Area A, the rapid burial of the structures, possibly due to a fire event, and the occurrence or rich assemblage on the last occupation floor, suggested a possible abandonment ritual, in Building-unit 2 of Area B, the gradual collapse of the structures and the absence of materials on the occupation floor, may possibly be indicative of a planned abandonment, with objects selected and moved away after the last occupation phase. At a speculative level this evidence would possibly difference the abandonment practice of public spaces, as in buildings of Area A, where communal objects were left behind and possibly ritualised, and the abandonment practices of private spaces, as in Building-unit 2 in Area B, where personal objects were removed and carried out by their owner (Joyce and Johannesen 1993; Kent 1993).

8. DISCUSSION

8.1 Introduction

The principal aim of this research project is to investigate the formative period of Cypriot urbanism, through a multi-scalar and interdisciplinary analysis of architectural materials, forms and practices, and concepts and representations of built space. At the basis of this interest is the concept that architecture, as key-media for exploring cultural choices, social representation and community interaction, can provide a privileged viewpoint for exploring the formation, reproduction and development of past societies (Fisher 2009; 2014a; Robb 2010; Bloch 2010).

Middle Bronze Age Erimi-*Laonin tou Porakou* (MC I-MC III, ca. 1950-1650 BC) offers an ideal case-study to investigate this topic, as it enables analysis of social, cultural and economic transformations between the village-based rural society of Early Cyprus and the Urban society of Late Cyprus, with which to enhance the analysis and definition of 'proto-urban' period in Cyprus (Manning *et al*. 2014; Fisher 2014a; Fisher 2014b).

The application of an interdisciplinary scientific approach at Erimi-*Laonin tou Porakou* and the consequent production of a multi scalar data-set, through the dialogue between field and laboratory practices, has contributed to broadening the existing set of archaeological and architectural data in Cyprus and provided new data with which to analyse and identify key socio-cultural and economic aspects of settlements and communities that mark the recent Cypriot prehistory-early protohistory and the 'proto-urbanisation' phenomenon.

The role of architecture as media for expressing social reproduction and as the context of social actions and interaction has been examined in this research project through increasing scales of analysis, from the microscopic analysis of deposits and architectural materials to the macro analysis of architectural forms.

In Chapter 4 components and deposits types were analysed and classified through the integration of field observations with micromorphological and geochemical analyses in order to reconstruct site formation processes and to interpret cultural behaviour and settlement history (Matthews *et al*. 1997; Schiffer 1987; La Motta and Schiffer 1999). Deposit types were further examined in Chapter 5 in critical analysis and discussion of architectural materials and technology. Micromorphology has been coupled with geochemical and spectroscopic analyses to study source materials, properties and techniques in the selection and manufacture of architectural materials and occupation surfaces. In Chapters 6 and 7 field excavation data,

geoarchaeological, archaeobotanical and architectural evidence were analysed to reconstruct the micro-history of the proposed productive and residential areas of the settlement, Area A and B, from construction and use to abandonment of the structures. This analytical step was fundamental to study how space was used and transformed through time and the implications of this for examining socio-cultural and economic changes.

The results produced are discussed in this chapter according to the specific research aims, set out in the introduction: the study of architectural materials to analyse ecology and material engagement and network; the study of spatial and temporal variations in use and concept of space within buildings and households to examine the impact of every-day activities and practices in the formation and reproduction of social identities, roles and relations; the study of spatial organisation and role of buildings and settlement areas, to analyse the built-environment as active facilitator of particular social interactions through which identities, roles and statuses were negotiated and displayed (see Section 1.5).

8.2 Assessing methods for the analysis of built-environments

Previous methodological approaches to the analysis of built-environment and architecture of Bronze Age Cyprus have been principally based on classification and description of architectural form, buildings structure and settlements layout to trace patterns of evolution in social structure and organisation (Hult 1983; Astrom 1972; Catling 1963; Wright 1992). However, as Fisher (2014a, 409) pointed out, the process of classification itself might limit the informative potential of built-environment analysis, as it excludes the possibility of examining buildings and settlements as unique products of both communal and individual choices. Built-environments - Fisher affirms (2014a, 401) - 'are lived spaces laden with identities and memories that make them both product and facilitators of social life'.

More recent studies have shifted the attention from buildings and settlements as standardised socio-cultural entities to households as dynamic agents, which are viewed as the basic socio-economic unit of societies and loci of actions, where personal identities and economic, social and ideological interests are reproduced and negotiated (Bolger 2003, 41-50; Fisher 2014a; Frankel and Webb 2012b; Webb 2009; Fisher 2007; 2009a; 2014a; 2014b; Kearns 2011; Manning *et al.* 2014). According to this research direction, households are not only functional units but also places of social relations, which are created through practices and interaction (Fisher 2014a, 400-402; Meskell 1998; Hendon 2004). This new approach, explored in this thesis, permits investigations of the social implications of building choices at households and settlement scale and examination of architectural evidence as an important data-set, with which

to analyse developments and transformations in Cypriot societies during the Bronze Age period.

The limited number of Middle Bronze Age contexts excavated in Cyprus to date has limited the possibility to investigate socio-cultural developments of Prehistoric-Protohistoric Bronze Age transitional phase, and therefore the potential to address larger social questions, such as the development of urbanisation phenomenon and increasing social complexity in Cyprus. In addition, the presence of shallow stratified contexts, which do not offer multi-period sequences (Frankel *et al*. 2013) and the consequent sparse preservation of deposits and materials left within buildings and settlements, inhibits the exhaustive analysis and reconstruction of household structures and activities.

For these reasons one of the aim of this project was to test the application of a multi-scalar methodological approach that is able to integrate field investigation and macro analysis of architectural forms, buildings and spaces with high resolution analysis of stratigraphic sequences, deposits and materials within buildings and in settlement areas, in order to collect the maximum informative potential from the archaeological context analysed and to create a more holistic data-set, which would enable analysis of architecture at different spatial and temporal scales.

As explained in the methodological chapter (see Section 2.1) the application of a scientific interdisciplinary approach to the analysis of Middle Bronze Age Erimi-LtP is the result of constructive collaborations between the director and members of the Kouris Valley project (www.erimilaonin.it). The synergy between archaeologists and specialists working at the site contributed to development of an effective methodological approach able to address the research questions of this thesis project and to support integrated excavation practices, archaeological investigations and specialist studies, notably radiocarbon and archaeobotanical analyses. For instance, the application of microstratigraphic and micromorphological analyses greatly contributed to refine the sampling strategy in radiocarbon analysis by providing essential information about depositional contexts and histories of selected charcoal samples (see Scirè-Calabrisotto *et al*. 2017).

The combination of standard field practices with architectural analysis of buildings and settlement areas, micro stratigraphic analysis of depositional sequences and high resolution analysis of architectural materials, surfaces and occupation deposits, allowed us to acquire multi-scalar evidence with which to strengthen the analysis and interpretation of the contexts analysed. It enabled production of a wide-ranging data-set for analysis of architecture and the

activities within it, and supported a life-history approach to study the creation and use of architecture and reconstruction of settlement from the construction and use to the abandonment of the structures.

The innovative aspect of this approach was the attention to deposits, surfaces and micro-materials as media that were used to create and define social settings and boundaries and as embodiments of the histories of people and place (Matthews 2012, 183-185). The application of microscopic analysis and the examination of microstratigraphic sequences within buildings and settlement areas contributed to the identification of activity areas and to the interpretation of individual and community practices by examination of traces of surfaces and activities at high-resolution timescales (Boivin2000; Matthews 2005a, 2005b).

Data resulting from these analyses provided new multi-scalar evidence with which to interpret socio-cultural developments and transformations at Erimi-LtP and, at larger scale, to reconstruct socio-cultural dynamics and innovations during the recent Prehistory-early Protohistory in Cyprus.

8.3 Scales of analysis in study of architectural continuity and transformation

Interpretation and discussion of the evidence examined and presented in the results chapters are organised in the following sections according to increasing scales of analysis, from household to settlement level. This structure is designed to examine arguments from smaller to larger research themes in order to examine the project aims and discuss bigger research questions.

At the household scale the discussion considers aspects of continuity and transformation in human-environment inter-relationship to analyse individual and communal choices in selection, use and perception of natural materials. Continuity and transformation in technology and manufacture of architectural materials are then analysed, to examine aspects of labour organisation and technological development and related socio-cultural and economic practices (Love 2013a; 2013b; Matthews *et al.* 2013). Finally, performance of buildings, architectural forms and materials are considered to analyse the creation of spatial conventions and how these may represent and influence social actions and reproduction and the development of supra-household socio-economic systems (Boivin 2000; Matthews 2005a; Souvatzi 2008).

At the larger settlement scale, aspects of continuity and transformation are examined by analysing changes in settlement layout and variation in the role and representation of settlement

areas, in order to study possible developments in socio-cultural conventions and examine how the built space was structured and experienced (Cutting 2003; During 2006; Fisher 2007; 2009).

The data are discussed presenting analogies and differences between architectural evidence from Middle Bronze age Erimi-LtP and those from representative Early, Middle and Late Bronze age contexts to evidence possible aspects of innovations at this Middle Bronze Age site and generate new insights into the formative process of urbanisation and complexity in Cyprus.

8.4 Understanding transformation at household scale

Aspects of continuity and transformation at household scale are examined and discussed by taking into account the main phases of household formation and reproduction: building construction, use and abandonment. Each of these phases provided diagnostic elements to discuss the way architecture configured social practices and enacted the formation, reproduction and transformation of identities, roles and statuses.

8.4.1 Environment, ecology and material engagement and networks

In this section, the relation between environmental setting and the use of specific materials is explored in order to analyse the role of natural environment in the formation and reproduction of socio-cultural identities and the wider ecological and social implications of this in the practice of procurement and selection of natural materials used in building construction.

Analysing the choices involved in architectural material manufacture enhances the knowledge of the social processes involved in house construction. What are the practical and socio-cultural reasons that dictated the choice of building materials? Can material composition be used as indicator of social inequality through preferential resource access and selection? Was the accessibility to natural resources controlled? What was the level of labour organisation and specialisation? The results of these analyses are then used to examine social organisation and the degree of complexity at Erimi-LtP and wider comparisons with building practices and socio-cultural organisation and complexity in other Bronze Age Cypriot contexts.

8.4.1.1 Natural environment and procurement strategies

Previous analysis of Anatolian architecture sustained the existence of a direct relationship between availability of natural resources and choice and use of specific building materials (Braidwood and Braidwood 1982; Duru 2002; Woldring 2002). However, as Love (2013a, 749-751) points out, the materials employed in construction are not only indicative of what resources were available but illustrate how culture has a significant impact on the built form and choice of materials. At Erimi-LtP the abundance of natural resources, certainly supported

the building activity but did not solely influence the choice of materials. A wide range of materials was selected and manipulated for building material manufacture, as suggested by the different composition of earthen products for mud-bricks, roofing and ceramic production (see Section 5.2.1) and of calcite-rich products for plaster and mortar production (see Section 5.2.2). The new results from this thesis on choices and processes in selection and modification of natural resources demonstrate a profound knowledge of the local material properties and an established engagement with the natural environment and development in technology, as also discussed in Section 8.4.2.3.

The comparatively soft and excavable calcareous geology of the local Pakhna formation, which characterises the middle valley of Kouris River, I argue was advantageously used in constructional practices. I advocate that the settlement area was deliberately chosen for its geological and geomorphological characteristics. The choice of building structures, by carving into the limestone bedrock to create semi-sunken floors and to provide and integral wall base on which to construct walls with stone and mud-bricks, might be interpreted in practical and ideological terms. From a functional point of view the technique of construction by carving into the limestone bedrock provided greater stability to the structures and improved insulation against hot summer temperature and water ingress and damp and humidity during rainy winters, increasing life-quality conditions. From an ideological perspective, the use of this material and technique is likely to have contributed to create a sense of immutability, which possibly fostered the formation of community identity and memory (Knapp 2009). In addition, as stone embodies a permanence, it is likely that the community used this to communicate social order and to negotiate power (Fisher 2009b, 192-193; Bukach 2003, 21). In addition, by considering the multisensorial characteristics of this natural material, other significant meanings and values can be examined in future studies, by analysis of visual, tactile and acoustic properties of limestone (Tilley 2004, 35; Fisher 2009b, 192).

Analysis of evidence from other Bronze Age Cypriot sites and regions supports the argument that selection and use of certain building materials and technique are significantly influenced by culturally-based choices. The Early Cypriot site of Sotira-*Kaminoudhia*, is less than 10 km distant from the site of Erimi-LtP and it is characterised by similar geological formation, dominated by chalk and marl (Fig. 8.1). Despite the similarities in natural resources with Erimi-LtP area, *Kaminoudhia* was constructed using different materials and techniques. Most walls were founded directly on bedrock or on sterile eroded material overlying the latter; foundation trenches were cut out of the soft limestone bedrock only in walls of Units 19 and 20 in Area A (Swiny *et al*. 2003, 56). Calcareous fieldstones were the principally attested material in wall

construction, while mud-bricks were rarely used (Swiny *et al.* 2003, 59). At the Early-Middle Cypriot site of Marki-*Alonia*, along the course of Alykos river, in Nicosia District, walls were normally built of mudbricks laid on stone footings. While clay was readily available from the lower slopes of the Alykos river valley, stones used in footings, especially calcarenite blocks, were brought from a considerable distance (Xenophontos 1996, 18; Frankel and Webb 2006, 7). Despite the thesis sustained by Frankel and Webb (2006, 7) in favour of an environmental-determination in material selection, this evidence attest the primacy of material choices and agency over resources availability (Love 2013a, 751), and validates the argument that the relationship with the physical environment is socially constructed (Ingold 2012; Evans 2003). At the site of Early-Middle Cypriot Alambra-*Mouttes,* which is situated between the sedimentary deposits of the central lowland and the igneous formation of the Trodoos mountain (Fig. 8.1), mudbrick structures were built on a calcareous field stone footing. Even though the site was constructed on limestone bedrock floor, buildings and rooms were not carved into the foundation bedrock (Coleman *et al*. 1996, 21-25). Similar materials and techniques to those observed at Erimi-LtP, were identified at the Late Cypriot site of Erimi-*Bamboula,* placed on the costal side of the Kouris river Valley and characterised by a calcareous formation of chalks and marls. In Area E, Weinberg (1983, 54) reported that structures were constructed almost entirely into the bedrock floor 'leaving a base where the wall foundation was laid' (Weinberg 1983, Pl. 12 a). The similarity in materials and techniques adopted at this LC site and at MC Erimi-LtP sheds light on possible circulation of technical knowledge, between communities that settled the Kouris Valley area between the end of PreBA and the beginning of ProBA, possibly fostered by marriages and trade contacts.



Figure 8.1 Geological map of Cyprus showing main geological formations and archeological sites mentioned in Section 8.4.1.1.

The examples examined demonstrate that, in contrast to what previously claimed (Frankel and Webb 2006, 7; Coleman *et al.* 1996, 23-24; Swiny 2003, 59), the selection of building materials and the use of specific building techniques are not only dictated by immediate availability and convenience, but also determined by cultural choices and social restraints (Arnold *et al.* 1991, 88; Neupert 2000).

8.4.1.2 Accessibility and selection to local resources

Compositional analyses conducted on mud-bricks and plaster revealed that a wide range of locally available materials within a range of 5km from the settlement area were used, and that these materials were selected and manipulated according to different 'recipes' in order to produce diverse constructional products. The data-set examined revealed that no dominant household had exclusive access to or control over a particular resource. If one group owned or controlled a specific resource this material would be expected to be spatially limited to one building or few more buildings. On the contrary data analysed attest the occurrence of specific mudbrick and plaster types that were recurrently selected and used in many buildings of the settlement and which were possibly the product of specific recipes and specialised labour (see Section 8.4.2.1).

The small number of identifiable and preserved mudbricks and the shallow site stratigraphy of building levels, 50-60 cm deep (see Fig. 6.4), limited the study of possible temporal variations in the composition of these products, which may be attributed to exploitation of different areas and resources through time, and to possible different roles and representation of buildings. In addition, the restricted availability of comparative scientific data from other Bronze Age Cypriot contexts, does not yet permit establishment of wider comparisons to analyse the initial stage of social inequality and resource and land control at the beginning of ProBA.

The evidence analysed suggests that the selection of raw materials might have responded to 'specialising (procurement) strategy', according to the classification of this by Bishop *et al.* (1982, 32-60), as different raw materials were selected and used for producing different product types. For example, terra-rossa soil was selected for mud-bricks production as naturally rich in carbonate rock inclusions, which contribute to prevent cracks and rapid degradation of earthen architectural materials (see Section 5.2.1; Hoard *et al.* 1995). The specialisation in material selections and modification is also attested in the selection of specific tempers for particular material types, which was observed both in earthen architectural materials and lime-plaster types (see Section 5.3.1). Procurement of raw materials seems to have been based on local resources. The results from materials analysed suggest that resource selection was not

influenced by socio-political factors and to restriction and control on land and local materials. On the contrary, the differentiation in composition in constructional materials suggests that local resources were selected by builders on the basis of knowledge and perception of practical and functional choices as well as construction and artefact types (Sillar and Tite 2000). The evidence of community-wide use of specific resources for material contexts and functions might support the assumption of the possible existence of cooperative forms of labour and specialised work (Arnold 2000, 341-357).

8.4.2 Integrating analysis of socio-economic and technological choices and practice in building construction

Understanding the technology of building construction is fundamental to analysis of the socio-cultural choices operated by individual and communal agents and therefore to reconstructing the socio-cultural context in which these agents acted and influenced (Sillar and Tite 2000). The recognition of the active role of material culture in the construction and reproduction of social relations and cultural values has the potential to enhance the analysis of past societies, through the examination of material choices, labour investment, craft specialisation and level of technical knowledge (Bourdieu 1977; Hodder 1986; Lemonnier 1992; van der Leeuw 1993).

8.4.2.1 Labour organisation and scale of production

The study of organisation of building activities and production was supported by the analysis of stone working, mud-bricks and lime-plaster manufacture. Evidence analysed at Erimi-LtP revealed a level of labour organisation and production possibly at supra household level.

As examined in Section 5.3.4 the analysis of limestone technology revealed that the operations of carving and dressing building rooms and features, were possibly regularised and conducted by specialised workers. Even though the lack of working tools recovered at the site limited the possibility to identify the utensils employed in settlement construction and therefore to ascertain the technological elaboration of these (on this topic see Amadio and Chelazzi 2013), the analysis and observation of tooling marks left on the bedrock surface permitted to identify recurrent patterns in tools and techniques used, which may be ascribed to specialised skills. In support of this, in Section 6.3, I pointed to the attention to the planning and orientation of settlement areas and buildings, and to the extensive cutting of the bedrock floor, involved in settlement design and construction (Bombardieri *et al.* 2014), which suggests a degree of expertise and labour organisation likely to have involved decision making at supra-household level.

The identification of specific recipes in mudbrick (see Fig. 5.13) and plaster productions (Section 5.3), the use of selected tempers to obtain diverse products (e.g. the use of ceramic tempers in lime plaster deposit Type 8a, to produce a hard and waterproofing materials to be applied on mortar installations), and the repeated occurrence of specific material types in different areas and buildings of the settlement, suggest that the production was most probably by workers specialised in building tasks and the recurrence of this across the settlement suggests that this was organised at communal level.

Further evidence in support of this argument may be extrapolated by the analysis of fired lime-plaster technology and the extent of its use. This thesis has demonstrated that considerable quantities of presumably fired lime-plaster were used in each building of the settlement. Calculation according to current standard building practices (Berge 2000; Wright 2005, 144-178) indicates that approximately 100 cm^3 of material were required to plaster 3 cm thick floor layer in building SA I, of 37 m^2. The large work investment, including fuel procurement and use, excludes the possibility of household production and reinforce the idea of consistent high-level skills and knowledge by specialised crafts people and possibly a centralised production, which was organised over the individual household level (Matthews *et al*. 2005, 127; Özdogan 1999, 230-232; Love 2013a, 755; Love 2012, 145-146).

There is, however, evidence that some building activities were organised at a smaller household/neighbourhood scale within the settlement of Erimi-LtP. These were principally related with activities of buildings repairing and maintenance, as indicated by the different occurrence of lime-plaster floor layers between buildings of the communal productive Area A (2 or more) and buildings of the proposed residential Area B (only one) (Matthews 2005, 369-370).

A similar picture characterised by the co-existence of two modes of productions and labour organisation (household and supra household/specialised) may be inferred by evidence from analysis of other uses of 'clay' materials in pottery production at other Prehistoric and Protohistoric Cypriot contexts. According to Steel (2010, 106-109) and Crewe (2007, 216, 227) in the transitional MCIII-LCI phase both household and specialised productions were attested. On one hand, the existence of regional variations, characterised by diverse vessels types and shapes, indicates that pottery production continued to be at small-scale (Crewe 2007, 216, 227; Steel 2010, 108-109). This village-based industry reflects the productive system of EC contexts as Marki-*Alonia* and Alambra-*Mouttes,* where the manufacture was organised at household scale (Frankel and Webb 1996, 110-111; 2006, 149-153). On the other hand, the appearance of

new wares, characterised by the exploitation of new clay types and improved manufacture techniques, including the use of wheel for certain elements and the increased firing temperatures (Steel 2010, 108), suggests a specialised production within formal ceramic workshops, as exemplified by productions of LC Morphou-*Toumba tou Skourou* (Vermule and Wolsky 1990) and Episkopi-*Phaneromeni* (Carpenter 1981; Swiny 1986).

8.4.2.2 Labour organisation, gender and complexity

The study of social agency in technological and labour organisation cannot preclude examination of gendered practices and strategies (Dobres 1995). Technology, indeed, serves as arena in which social interactions in the planning, production, use and repair and discard of material culture are defined, expresses and negotiated (Dobres and Hoffman 1994, 224).

Traditional views of past societies have often relegated the role of women within the household space, and have limited women's practices to household-based activities. Studies conducted by Diane Bolger on engendered materials and spaces in Cyprus have demonstrated that there is a little evidence for polarised gender categories during the earlier phases of Cypriot prehistory (Bolger 2010, 162-163). This argument is well exemplified by results of the experimental work with use of 'clays' in chalcolithic pottery conducted at the Lemba village (Shiels 2003; Bolger 2003), which indicates that the organisation of working practices, especially if they require complex operational sequences, such as pottery and building materials making, are likely to demand the collective and collaborative efforts of men, women and even children. Data from Erimi-LtP supports the suggestion that wider age groups and genders are likely to have been involved in construction and productive activities. The identification of three small fingers prints on an earthen building material, possibly pertaining to roofing structures of Unit 2 in Area B, suggests that women and possibly children were actively involved in building tasks (Section 7.4.1).

The analysis of mortuary practices at Erimi-LtP have not provided evidence of gender differentiation. However, evident indications of status distinctions have been identified in the variations of architectural elaboration of tombs and in the differences in number and types of buried objects (Albertini 2017). Future analyses and excavations will possibly allow us to recover and collect more data to examine engendered architectural practice and technologies at Erimi-LtP, but also to possibly identify temporal variations in gender division and labour practices, which may be connected to development in socio-economic complexity. In fact, If the gender equality characterises the prehistoric phases of Bronze Age Cypriot societies, this highlights the importance of indications of increasing distinction between male and female

roles observed in Late Bronze age communities, attested particularly in mortuary practices (Bolger 2010, 156-163).

8.4.2.3 Development in building technology

The analysis of architectural materials and techniques used at Erimi-LtP permitted us to trace a more composite picture of technological skills and development in this Middle Bronze community, by combining evidence from stone, mudbrick and plaster technologies.

The extensive practice of exploitation of the bedrock floor in settlement construction and the high organisational and technological skills adopted to realise such an ambitious plan have been already evidenced in Section 8.4.2.1 and provide indication of the amount of labour invested (Fisher 2009b, 190-194). Trigger argues that the ability of individual to engage in conspicuous consumption of energy and labour may be representative of power and control over natural and human resources and, therefore, may demonstrate more complex social organisation (Trigger 1990, 128-129; see Section 1.3). If this assumption endorses the idea that the technological and organisational level of Middle Bronze age Erimi-LtP community was advanced from the outset at the first stages of settlement construction, evidence from the analysis of stone dressing indicates that a progressive development in stone working techniques was acquired during the later occupation Phase A at the end of Middle Cypriot period.

The best example of technological development in stone working is represented by the high-level technique in carving the monolithic thresholds identified in building-units SA I, SA IIa, SA III and SA IV in Area A; these represent a great enhancement in architectural elaboration and marking of boundaries (see also Section 8.4.3.2) of buildings of Area A during the later phase A. The regular proportion of these limestone blocks and the elaborate dressing technique applied to the limestone make them classifiable as a prototype ashlar technology. I argue that these thresholds may be considered the very first example of ashlar masonry identified in Cyprus to date, preceding the drafted ashlar blocks of LC I Nitovikla fortress (Fisher 2009b, 192; Wright 1992, 410) and reinforcing the idea, advocated by Hult (1983, 88-90) and Wright (1992, 520-21), that ashlar architecture is a product of Cypriot manifestation and not the result of external influences (Hadjisavvas 2007).

Macro-morphological analysis of mud-bricks recovered at the site suggests that both hand-shaped and mould-shaped mudbricks were produced at Erimi-LtP. The lack of standardisation in the production, as revealed by the absence of recurring sizes in mud-bricks recovered and analysed, does not always indicate a lower level of manufacture specialisation. In fact, the method of production may be affected by many variables including social, environmental and

technological choices (Arnold 2000, 361-365) and developments in technology are not necessarily of uni-linear evolution (Matthews *et al*. 2013, 125-128). As discussed in Section 8.4.2.1, the presence of recipes identified in mud-bricks composition may furnish valid indication in support of manufacture specialisation in this industry. No fired brick prototypes have been recovered at Erimi-LtP and spectroscopic analysis certified that alterations observed on mud-bricks and earthen constructional materials are the result of post-depositional fire event (Section 5.4). The production of fired brick at Early Cypriot Marki-*Alonia* attests the circulation of pyrotechnical knowledge within this prehistoric communities, possibly as result of advancement in pottery technology and the formation of an 'elementary-specialisation' in production (Frankel and Webb 2006, 149-153).

The lack of evidence of pyrotechnological development in mud-brick production at Erimi-LtP, however, is not due to lack of technological skills. New infra-red spectroscopic analyses in this research have provided new data on fired lime lime-plaster production at Erimi-LtP. Evidence analysed in Chapter 4 and 5 and contextualised in Chapter 6 and 7 shows a widespread use of presumably fired lime-plaster at the site and a high level of expertise in plaster pyrotechnology. This new evidence from Middle Bronze Age Erimi-LtP enlarges and enhances the existing data-set about fired lime-plaster technology in Cyprus and demonstrate that the production of lime-plaster during this period was not inferior to Late Bronze Age production as argued by previous researches (Philokyprou 1998; 2011, 187).

Data from Erimi-LtP show an increase and improvement in lime-plaster production during the Middle Cypriot period. This is demonstrated by the application of multi layers of presumably fired lime-plaster floors in buildings of Area A during the later Phase A and by the introduction of lime-plaster floors in structures of Area B, where foundation bedrock was used as floor during the earlier Phase B. The production and use of specific plaster-types, which Philokyprou identified as exclusive and innovative products of LC period, e.g. 'hydraulic' lime-plaster tempered with crushed bricks/ceramic attested at Kition, Hala Sultan Tekke, Maroni-*Vournes* and Kalavasos-*Ayios Dhimitrios* (Philokyprou 2012, 188-192), is a major indication of the high technical skills and pytotehcnological development reached by the community of Erimi-LtP, possibly as result of an improved labour specialisation and increased social complexity at the end of Middle Cypriot period (Bombardieri *et al*. 2013).

Optical microscopic analysis conducted on plasters from many prehistoric and protohistoric contexts in Cyprus (Philokyprou 1998; 2012a; 2012b) revealed that during the Early and especially in the Middle Bronze age sites, mud-plaster was more attested than fired lime-

plaster; although fired lime plaster technology was wide-spread during Neolithic and Chalcolithic periods (e.g. Khirokitia, Kalavassos-Tenta, Kissonerga-Mosphilia). The use of fired lime-plaster is attested at EC Marki-*Alonia*; however, this material was not frequently applied in floors construction as at Erimi-LtP (Frankel and Webb 2006, 10-11). At EC Sotira-*Kamoinoudhia* the use of fired-lime plaster was restricted. As in buildings of Area B at Erimi-LtP, in many buildings at Sotira, the foundation bedrock was used directly as floor without any plaster application, even if the calcareous geology of the area provided abundant raw materials and the natural environment offered easy access to water and wood resources (Swiny 2003, 60-61). The preferential use of mud-plaster in floor and wall surfaces at the MC site of Alambra-*Mouttes* constitutes further evidence of decreasing fired lime-production during EC-MC period (Coleman *et al*. 1996, ,25; Philokyprou 2012, 187). The use of fired lime-plaster for specific buildings, however, highlights the importance of this material in specific contexts, as identified by Gjerstad, who reports the occurrence of fired lime-plaster floor at EC-MC Alambra-*Asproyi* and in room 6 at MC Kalopsidha (1926, 22-29; Frankel and Webb 2006, 10-11). Nevertheless, it is important to consider that the detection of fired lime-plaster is always problematic in archaeological contexts, especially in the absence of scientific analyses, and that interpretation solely deriving from optical examinations are not enough to distinguish between fired and non-fired lime plaster, as discussed in Section 5.3.3 (Wright 1992, 387-391; Thomas 1998, 57-58).

8.4.3 The performance of buildings and architectural forms

The concept of built-environment as space where social systems are produced, reproduced and transformed is explored in this section through the examination of architectural elements that were used to configure the building space and make them a place of interaction and social reproduction. Since buildings structure daily life and the life-course as well as exceptional events and communicate experiences and memories through their materials, shape, size, ornamentation and placement, the analysis of these constituent elements may be used to define spatial and socio-cultural conventions, values and boundaries (Fisher 2014a; Love 2013b; Matthews *et al.* 2013; Rapoport 1990; Rasmussen 1962, Souvatzi 2012).

The role of buildings and architectural forms in structuring social-identities and status is discussed through the analysis of building shape and size, the use of specific fixed and semi-fixed elements and the occurrence of portable objects as significant indicators of social conventions and transformations. Performances within buildings are then analysed giving special attention to floors, surfaces and occupation deposits as means of social organisation and representation.

8.4.3.1 The social significance of buildings shape and size

Wall and spaces serve as tangible and concreate boundaries, which are used by individuals and communities to organise their and others social-lives, creating places of action and interaction. Analysis of transformations in buildings shape and size, and the study of increasing space segmentation, are investigated in this research to provide insights into the socio-cultural developments of past society and, in the specific case, of Bronze Age Cypriot communities (Kent 1990, Rapoport 1990; Hodder 1990; Bolger 2003, 21-50).

Previous studies on development of spatial organisation in Cypriot Bronze Age household contexts have revealed the increasing construction of specific standard building types during the second millennium BC (Wright 1992:211; Fisher 2014a, 402-403; Bolger 2003, 21-50). The irregular shape and size of buildings in EC sites such as Marki-*Alonia* and Sotira-*Kaminoudhia* were gradually replaced by more regular buildings, characterised by rooms arranged around a front porch or courtyard with a L-shaped layout. The primitive example of this new household type is embodied by the 'row houses' of EC-MC Alambra-*Mouttes* (Coleman *et al* 1996, Fig.11; Bolger 2003, 34-35); whilst a more definite prototype is represented by MC III house at Kalopsidha-*Tsaoudhi Ciftlik* (Gjerstad 1926:27-37) and by LC buildings of Episkopi-*Bamboula* (Weinberg 1983, Figs. 23, 24).

However, as I advocated in Section 8.2, referring to more recent approaches to household studies, buildings development and transformation are not always uni-linear in evolution, as households and societies are based on a 'fluid sets of relationships, which validate and transform each other' (Souvatzi 2012, 15). I argue that, even though similar traits and characteristics can be encountered and identified in buildings structures due to norms dictated by social and natural constraints, buildings form and design and their use, are the results of unique choices, which are in constant state of transition, since households and societies are not static entities (see Section 8.2). The new microstratigraphic approaches in this thesis (see Sections 1.2.4, 8.2; Chapters 4, 6 and 7) provide new ways of recording and measuring these more dynamic lived histories as examined in Sections 6.8, 7.5 and 8.4.3.4.

At Erimi-LtP the analysis of house forms and shape revealed the coexistence of two distinct patterns. Buildings of Area A are characterised by regular, rectangular shape and large size (between 25-35 m^2), while buildings of Area B are characterised by more irregular shape, and smaller size (15-20 m^2). While buildings in Area A were constructed to be parallel each other, buildings of Area B were not organised according to a structured plan, and reveal basic similarities to the agglomerative settlement plan characteristic of EC Marki-*Alonia* and Sotira-

Kaminoudhia (Fig. 8.1). However, despite these marked differences, buildings and open spaces in these two areas of Erimi-LtP settlement are characterised by similar NE-SW orientation.

I sustain that the increasing standardised orientation of buildings within the settlement (see also 8.5.1.1) is an interesting aspect in the discussion of social and cultural implications associated with transformations of architectural properties. In fact, the lack of houses orientation characterises EC-MC household contexts as at Marki-*Alonia*, Sotira-*Kaminoudhia* and Alambra-*Mouttes* and suggests that household construction responded to individual household exigencies. By contrast, the occurrence of buildings oriented according to a wider settlement design and street plan at MC Erimi-LtP in Area A, as at later LC sites may be interpreted as indication of an important transition to increased communal decision making and higher social organisation level, and is, therefore, and important marker of increasing complexity in wider economic and social life, which has antecedents in MC Erimi-LtP (Smith 2007, 8). The uniformity observed at Erimi-LtP, therefore, may represent the emergence of a powerful organising principle (Paz 2012, 425).

The increasing segmentation of interior spaces and the subsequent creation of more private rooms within buildings have been identified as evidence of increasing social complexity in ancient communities (Kent 1984; 1990; Bolger 2003; Rapoport 1990). According to ethnographic studies conducted by Kent (1984; 1990), house interiors are likely to become more ideologically and physically segmented as household members have increasing number of tasks to perform (1990, 150). In examining the process of social development in Bronze Age Cyprus households, Bolger (2003, 21-50) and Fisher (2014a) have recognised the increasing segmentation and spatial definition of buildings, as innovative characteristics of Protohistoric Bronze Age houses, from c. 1650-1550 BC.

At Erimi-LtP, buildings were organised as large single spaces; however, an enhancement towards a segmentation of the built space may be identified in the passage to the later Phase A. The construction of small partition walls enhanced the definition of distinct buildings rooms, as in Building-unit 2 in Area B; at the same time the introduction of small annexes/entry halls, contributed to improve the compartmentalisation of building-units SA I and SA II in Area A. According to Fisher (2009b, 197), entry halls extended the role of the thresholds in building spaces, and by doing so increased the consciousness of the transition for those who moved through them. Halls, as well as thresholds, may be considered liminal spaces, and as such they function as physical and ideological boundaries and, therefore, contribute to structure movement and interaction within the built space, as further discussed in the following section.

LC buildings were constructed larger than the EC-MC counterparts and are characterised by more and smaller rooms, likely indicating that fewer people occupied and worked in them. The more complex division of space, which is already evident at the EC Marki-*Alonia* (Webb 2009; Frankel and Webb 2009; 2012) is argued to have improved the opportunity for privacy to household members and possibly marked the division of gender-related tasks within buildings (Bolger 2003, 37-41). The trend towards a segmentation of buildings space may be interpreted as manifestation of the functional specialisation, which characterises the increasing social complexity of Late Cypriot economic system (Fisher 2014a, 406; Keswani 1993; Knapp 2008, 167-168).

8.4.3.2 The social significance of fixed architectural elements.

Social settings are not only defined by buildings shape and size, but also by architectural forms, which contribute to determine social conventions and to encourage social interaction and reproduction in the built spaces. Fixed elements such as doorways, hearths and other furniture, together with their functional character, may be used to express socio-cultural ideologies and status and circulation and movement pattern and sequences, and interconnections of activities and inter-relations and, therefore, may be considered useful indicators in the analysis of social developments of past societies.

Among the fixed architectural components, doorways represent one of the most significant element of analysis. The importance of doorways as loci of access and transition between buildings spaces has been advocated by Fisher (2009a, 445; 2009b, 194-199), who sustains that doorways, beyond their topological function, are elements embedded with social and symbolic meanings (Fishers 2009a, 2009b).

The analysis of doorways at Erimi-LtP revealed a divergent pattern between settings defined in buildings of Area A and those defined in buildings of Area B. In Area A buildings are characterised by one access point, placed on the short, south wall of the structures. Exceptions to this layout are due to re-structuring of buildings between the earlier and the later occupation phase, especially in the case of open-areas turned into roofed structures, as building-units SA VI and SA IIb (see Sections 6.4, 6.5), and to distinct functions of buildings, as Building-unit SA III, which was equipped with two entranceways, and may have been designed to host public-inclusive occasions (see Section 6.6). In Area B, buildings are characterised by one access point, whose placement is dictated by the relationship between buildings and the concomitant courtyard (see Chapter 7).

Doorway width is an important factor to assess the level of interaction and social representation in any building. According to analyses conducted by Fisher, public-inclusive contexts are characterised by wider doorways than the private-exclusive ones (2007, Tables 8.2, 8.3; 2009a, Table 2). At Erimi-LtP access width appears to be proportional to the elaboration of doorway itself. Wider doorways are typically characterised by a higher elaboration score (see Tables 6.3, 6.4) and are related to buildings furnished with elaborated architectural installations and equipped with a larger number of objects, as D5 in Building-unit SA I and D10 in building-unit SA IIa, in Area A. On the contrary, narrower entranceways are characterised by a lower elaboration score, as doorway D.4, between Building-unit 2b and 2a in Area B (see Table 7.1 and Section 7.4).

The high level of architectural elaboration makes doorways at MC Erimi-LtP different from those of other EC Cypriot contexts. At Marki-*Alonia* (Frankel and Webb 1996, 58; 2006, 11), Sotira *Kaminoudhia* (Swiny *et al*. 2003, 59) and Alambra-*Mouttes* (Coleman *et al*. 1996, 27-28) doorways are marked by very simple thresholds and pivot stones and their placement seems to be dictated by household exigencies and not to respond to a homogenous, communal settlement design. The high-level dressing technique of Erimi-LtP thresholds, which are equipped with door-pivots and, in some cases, are flanked by stone slabs (D.100 in building-unit SA VI) and steps (D.5, building-unit SA I), makes them analogous to later LC ashlar prototypes (see also 8.4.2.3). Like Fisher (2009b, 194), I argue that the aesthetic elaboration is a means to attribute symbolic values to thresholds reinforcing the ideological significance of these liminal architectural forms (Blanton 1994: 117; Sanders 1990:61; Rapoport 1990), and I argue that this was highly marked at Erimi-LtP. In fact, the entries of many later monumental public LC Cypriot buildings were marked by ashlar thresholds as Room 14 in the level IIIA of Ashlar Building at Enkomi (Dikaios 1969), Building X at Kalavasos-*Ayios Dhimitrios* (South *et al*. 1989) and Building II at Alassa-*Paliotaverna* (Hadjisavvas 1989; Fisher 2009b, 186).

Thresholds may be identified as central elements of doorways (Unwin 2007, 33-35), as they tangibly mark the transition between spaces and the different ideological significance of these such as: indoor and outdoor, private and public, clean and dirt (Lang 1985, 206). Thresholds at Middle Bronze Erimi-LtP are very significant architectural forms. Their introduction in the later Phase A may be considered a marked innovation in perception and concepts of the built space and a testimony of the socio-cultural and economic development at the beginning of Protohistoric Bronze Age.

Hearths have an important role in structuring social life as they contribute to create places of belongings and transforming landscape and materials (Matthews 2016, 107-108). As sustained by Bloch (2010), hearths and fireplace were used to mark continuity in social roles and relations. The socio-cultural power of hearths is that they aggregate people and contribute to shaping social identity and memory (Dunbar and Goulett 2014). Also important is the potential of hearths and fire as source of energy in technological choice, as they provide enhancement in processing and production and therefore play a fundamental role in economic improvement (Sillar and Tite 2000; Clark and Yusoff 2014). Hearths were rarely placed within buildings at Erimi-LtP; however, their symbolic and social values are expressed by the enhancement of their architectural forms and aesthetic appearance during the later Phase A. In fact, if during the earlier Phase B, hearts were made of mud-plaster, in the later Phase A they were re-constructed with limestone slabs and lime-plaster. Furthermore, these hearths are associated with buildings characterised by higher architectural elaboration and more refined 'ashlar' thresholds, as hearth Ft. 4 in SA I, Area A (Section 6.4.4).

Other fixed elements contributed to turn spaces into places of interaction and social reproduction. The regular, dressed orthostasts, which were introduced in building SA IIa in the later Phase A, enhanced the structural and aesthetic properties of this space (see Section 6.5.1). At the same time, the occurrence of working benches, bins, basins and mortars within buildings of the settlement delineate multi-functional spaces, where different activities, public as well as private, domestic as well as ritual were conducted, and were socio-cultural identities were formed and transformed through daily practices (Fisher 2009b). In this research, they were plotted and used to interpret continuity and change and articulation of uses of spaces, as examined in Chapters 6 and 7.

8.4.3.3 Semi- fixed architectural elements, portable objects and complexity

Semi-fixed elements and portable objects within buildings may also provide important indication of social and cultural practices and developments. Nevertheless, it is important to consider that the occurrence and preservation of semi-fixed elements and portable objects within building deposits can be affected by cultural and non-cultural formation processes, and, therefore, an effort in understanding depositional histories of built structures in needed when approaching the analysis of these compositional elements and their social significance (La Motta and Schiffer 1999).

As identified by Love in her studies of architecture in Pre-Pottery Neolithic of Anatolia and Levant (2013a), size and placement of installations as querns, and mortar as well as storage

facilities may reveal changes in social practices, as the passage from communal to household production and vice versa (Love 2013a, 754-755).

The scale and relationship of storage facilities to buildings is an important indication of the economic organisation of households (Flannery 1972; see also Banning 2010, 75-77). At Erimi-LtP the distinction between storage facilities in more accessible open areas and enclosed within roofed buildings, become more marked in the later Phase A, when large pithoi and storage jars were largely enclosed and used within buildings of Area A. A preliminary study aimed at analysing the water based and storage activities at the site (Bombardieri *et al*. 2014a) estimated a capacity of approximately 500 lt. for vessels recovered from building-unit SA I. The large volume of products stored in this area of the settlement is only one of the aspects that may suggest an improvement in production at the end of Middle Bronze period. The association of pithoi and storage jars within buildings marked by elaborated thresholds is a clear indication of the increasing need to secure certain products and symbolise the importance of the stored products for this community (Bombardieri *et al.* 2014b). The significance of the products stored within these rooms and buildings at Erimi-LtP is further reinforced by the occurrence of imported pithoi and storage jars, possibly from Paphos area (Graham pers. comm.; Webb 2017).

While in Area A storage facilities continue to be associated with productive facilities, as also identified at LC Pyla-*Kokkinokremos,* Complex A and Episkopi-*Bamboula,* House A.VIII (Fisher 2009b, 403-404; Karageorghis and Demas 1984; Weinberg 1983), investigations in trenches in Area B have revealed the possible existence of an enclosed area designed for storage function, similarly to other LC contexts, as Building X, room 152 at Kalavassos-*Ayios Dhimitrios* (South 1989, 321).

As suggested by Bolger, the exigence to secure products may be related to the increasing level of social complexity and competition, when societies began to move away from the kinship-based structure (2003, 31-32; see also De Boer 1988; Chesson 2012). The change in storage practice may reflect evolving systems of ownership and property (Kuijt 2009; Kuijt and Finlayson 2009). The introduction of storage areas designed to secure surplus products and the enhancement of storage capacity is evident in many later LC sites, and during the central period of urbanisation processes, evidence of products privatisation is also attested (Bolger 2003, 41-50); but, as this thesis has shown, this process is clearly incipient in Middle Cypriot period.

The occurrence of prestige objects as imported vessels and metals at Erimi-LtP is limited to buildings of Area A and to tombs of the funerary Area E, where the number of imported vessels

and metals is higher and represents the diverse repertoires available to communities at the site during the Middle Cypriot period, and the increasing networks that they were engaged in. Even though the quantity of prestige objects is not comparable with the rich assemblages recovered in many LC contexts, it is important to consider that the number of valuable objects excavated at Erimi-LtP may be less than the original amount available at the site, due to the possible selection operated by the community members when they decide to abandon and move away from the settlement (see Sections 6.8.3, 7.5.3).

8.4.3.4 Spatial convention within buildings: floor, surfaces and occupation deposits

The application of microstratigraphic and micromorphological techniques in this thesis permitted enhancement of the study of other important architectural components as floors, surfaces and occupation deposits, through high resolution analysis.

As pointed out by Matthews (2013), referring to a study of Asatekin (2005, 389-414) on traditional residential architecture in Anatolia, different surfaces within a building may be selected to express the hierarchy of space and to determine community relationship (Matthews *et al*. 2013, 115). The analysis of floors, surfaces and occupation deposits offers potentials for detecting and interpreting the spatial conventions, through which economic and social relationships are represented and negotiated during the life-history of the settlement (Matthews and French 2005, 325; Parker Pearson and Richards 1999).

Plaster floors, other than revealing sensible indications of uses of materials and of technological advancement, are highly representative of socio-cultural conventions within the settlement. At Erimi-LtP the general consistency in type, thickness and frequency of floors and deposits across many buildings of Area A, suggested consistency in uses and concept of space. Furthermore, the consistency of floor frequency and thickness may be also related with episodes of construction, which may reflect seasonal annual activities as well as life cycle changes (Boivin 2000).

Floor plastering episodes represented important markers of buildings renovation during the life-history of Erimi-LtP. Instances were clearly documented of the introduction of layers of new plaster-type that corresponded to changes in activities within buildings, from dirtier to cleaner, from working to representative, and to enhancement in spatial and architectural elaboration of built space (Sections 6.8, 7.5). These examples include the introduction of prepared floors plaster in working open areas during the later Phase A, which marked the functional and ideological renovation of these built spaces in Area A, with the creation of small annexes, which were turned into reception spaces (e.g, WA V; SA IIb). Similarly, the introduction of

limestone slabs floor at the entrance of the large building-unit SA VI at the end of MC III, corresponded with and signed the architectonic renovation of this structure and its shift from productive to representative functions, as possibly consequence of the increasing need to create spaces of interaction and exchange at supra-community level (see Sections 6.7.7 and 8.5.1.4). Analogous changes in arrangement has been identified at LC Pyla-*Kokkinokremos* at the boundary between Room 7 and Room 3 in Complex A (Karageorghis and Demas 1984, 7-12; Fisher 2014a, 405).

Micromorphological observation revealed that the majority of floors analysed were maintained extremely clean (see Section 6.8.2); an evidence, which suggests the presence of common standard in daily activities, possibly associated with role and representation of these building, but also to sense of hygiene and purity, which was used to create community cohesion and social well-being (Clarke 2012). Similar maintenance practices were applied on floors at Alambra-*Mouttes* and Sotira-*Kaminoudhia,* where occupation debris were not allowed to accumulate on domestic floors when they were in use (Coleman 1985, 134; Coleman *et al*. 1996, 331; Swiny *et al.* 2003, 30-31). At Marki-*Alonia* occupation residues were either removed and deposited in communal middens, or recycled and reused as building fill in later occupation levels (Webb 1995, 65).

Wall surfaces were also used as a symbolic means to express socio-cultural identities and roles. The identification of wall painting on external walls of building-unit SA I, suggests that renders were not applied solely for functional purposes. As Clarke argued, wall plasters represented 'white canvas' that community/individuals used to express and represent themselves through the use of colours (Clarke 2012, 177-178). The contrast of white colour of plaster and red of ochre or terra/rossa used as pigments for painting (see Section 5.2.3), have acted as mnemonic device for evoking remembrances, creating memories and reproducing identities (Jones 2004, 174).

8.5 Understanding transformation at settlement scale

In this section, the analyses of social and cultural transformations between Prehistoric and Protohistoric Cypriot societies are conducted at a larger scale in order to consider changes and possible innovations in settlement organisation. Spatial and socio-cultural conventions are examined through analysis of settlement design, with attention to streets, neighbourhoods and open-spaces. The examination of social conventions within settlement are then evaluated to analyse how defined spatial settings may contribute to the formation and reproduction of social identities and economic roles.

8.5.1 Settlement organisation and Spatial conventions

Analysis of settlement structure can provide important insights into the organisation of ancient societies. Indeed, settlement layouts not only reflect and reproduce social order but also shape identities and social relations (Bourdieu 1977; Giddens 1984; see also Furholt 2016, 1196-1197). Among the elements taken into account in the larger scale analysis of spatial conventions, I consider in particular settlement layout and organisation of settlement areas, neighbourhoods, streets and open spaces in order to identify the elements of transformation between prehistoric and protohistoric contexts and therefore, to analyse related socio-cultural implications.

8.5.1.1 From agglomerative to organised layout

Reconstructing the developments of settlement formation is not an easy task. In a simplistic view concerning settlement structure and organisation, large, planned settlements are considered the result of more complex social systems, while smaller, unplanned ones are considered the product of more primitive forms of social aggregation (Smith 2007). However, settlements as a concept includes a broad spectrum of human agglomerations, ranging from few buildings to larger urban contexts (Düring 2006, 29-30; Banning 2010; Furholt 2012) and, furthermore, these are not static, but dynamic forms. For this reason, it is always preferable to approach the analysis of settlement organisation, in the context of the local settlement system (van Dommelen 1997: 270-272; see Sections 1.3, 1.4.1).

In Cyprus, rural villages of the Early Bronze Age, were organised in agglomerative forms, which are viewed as the result of gradual aggregation of household groups, following a demographic growth during the EC period (Knapp 2008, 123). The anatomy of this development is well represented at Marki-*Alonia*, which, with its 500 years of occupation, from the Early stages of the Bronze Age to its final abandonment in the MC II period, provides one of the best example of the 'agglomerative' layout (Fig. 8.1 a). Developments towards a more defined spatial organisation may be identified in the appearance of defined lanes and streets during Phase D (EC I-II), and in the different organisation of open areas and courtyards, which contributed to transform interaction potential within settlement areas and promoted new forms of space negotiation (see Section 8.5.1.2; Frankel and Webb 2006a, 313-315; Frankel and Webb 2006b, 287-302). However, the complete lack of buildings orientation persisted in the settlement until the last phases of occupation, suggesting a possible lack of centralised decisions and communal organisation. Similar layout and spatial structure characterises also the EC settlements of Sotira-*Kaminoudhia* (Fig. 8.1 b; Swiny *et al*. 2003) and Alambra-*Mouttes* (Coleman *et al.* 1996; Sneddon 2015), and a similar agglomerative pattern has been recognised

in Area G at LC Episkopi-*Phaneromeni* (Carpenter 1981; Swiny 1989). This form of settlement layout, which principally characterise Prehistoric Bronze Age Cypriot societies, reflects what Peltenburg defined 'an egalitarian ethos' (Peltenburg 1996, 27; Fisher 2014b, 187).

The analysis of settlement structure at MC Erimi-LtP provided new evidence to analyse the evolution of forms of organisation between Prehistoric and Protohistoric Bronze Age Cyprus, and to examine the manner in which spatial layout was used to define social settings and shape social identities in a non-elite context. Existing excavation data revealed that the settlement was organised in two distinct areas, Area A on the top of the hill and Area B on the lower terraces, separated from each other by open spaces and characterised by diverse forms of buildings organisation (see Section 8.4.3.1.). The proposed communal, Area A, was constructed with a regular layout, with buildings aligned according to a street system, whereas in the proposed domestic Area B, the organisation of buildings and open areas appear less regular and more similar to the agglomerative structure of EC contexts. The pattern recognised in Area A shows similarities with the organisation of buildings at LC Pyla-*Kokkinokremos,* where houses are aligned on the same orientation, as result of higher level planning (Fig. 8.1 f; Karageorghis and Demas 1984; Fisher 2014b, 197). The different organisation in the two areas of the settlement at Erimi-LtP may possibly correlate with and be due to constructional issues, since carving building spaces into a plateau is much easier than carving them into a sloping surface. Despite these differences, I suggest that the settlement design may be viewed as the result of a communal planning, based on the identification of coordinated orientation (NE-SW) of buildings and open-areas both in Area A and in B. The construction of an organised layout must have involved collective labour, planning and decision making, all of which imply organization at the community, rather than the household, level. The planning of a structured design and the construction of an organised settlement contributed to connect different buildings into a communal place-making, and provided a mechanism for enhancing social interaction (Souvatzi 2012, 26).

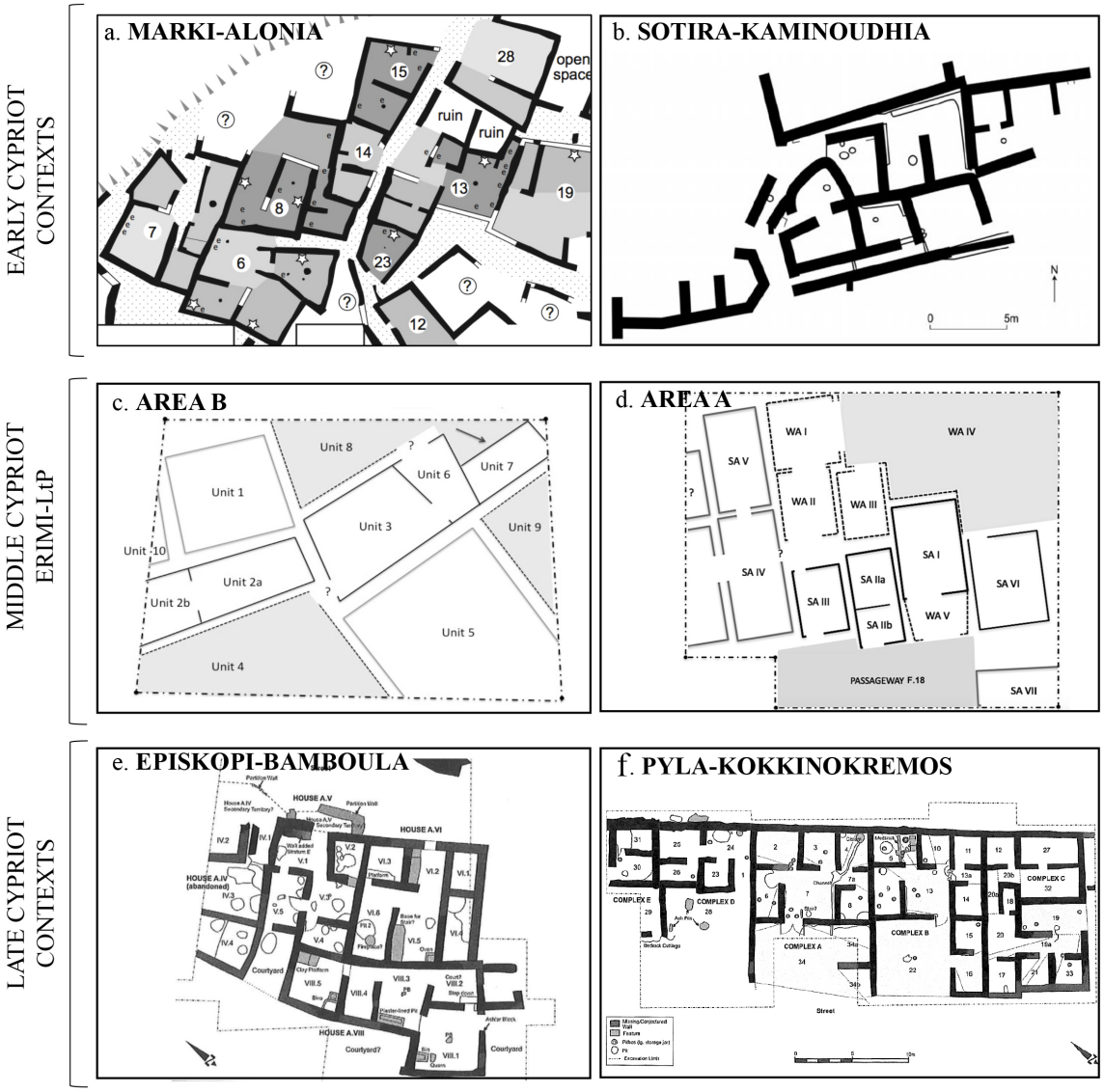


Figure 8.2 Building forms and settlement layout in Early, Middle and Late Cypriot contexts. a) Plan of Marki-*Alonia*, Phase F, after Frankel and Webb 2006, Fig. 11.6; b) Plan of Area A at Sotira-*Kaminoudhia*, after Swiny 1989, Fig. 2.2a and Webb 1999, Fig. 4; c-d) Plan of domestic Area B and communal, productive Area A at Erimi-LtP, after Bombardieri 2017; e) Plan of Area A, Stratum E at Episkopi-*Bamboula,* after Fisher 2014a, Fig. 23.3; f) Plan of Pyla-*Kokkinokremos*, after Fisher 2014a, Fig. 23.4.

This settlement organisation, characterised by distinct areas set amid open spaces, and the evidence of formal planning as result of decisions at supra household level, seems to reflect the organisational and ideological system of Cypriot urban contexts, in their early LC phases. In fact, as advocated by Manning *et al*. (2014, 6-10), the grid system of LC Enkomi, which has always been highlighted as exemplary of urban planning, represent only a re-organisation at the end of LC IIC –LC IIIA, ca.1200-1125 B.C. According to Manning's view, the organisation of Urban settlements in the early Late Cypriot presumably consisted of large open spaces between various structures and domestic quarters, as identified at Enkomi and Maroni (Manning *et al.* 2014, 8-9). Orthogonal plans are attested in LC IIC Kalavassos-*Ayios Dhimitrios* (South 1996; Urban *et al.* 2013) in LC III Hala Sultan Tekke (Astrom 1996; Iacovou

2007), and in the Later LC II-III phases of Enkomi (Dikaios 1969; Fisher 2007). The presence of a hierarchical organisation of power and role of central authority was expressed and materialised in the centralised planning based on regular articulation of streets and neighbourhoods, in the organised division of settlement spaces, and in the introduction of monumental administrative buildings and high status residences. As advocated by Fisher (2014b, 199), referring to Foucault (1977), 'configuration of space contributes to the maintenance of power […] through the control and surveillance of the movement of bodies through space'.

The available evidence on Bronze age Cypriot settlements to date provides a variegated sketch, whose lack of standardisation reflects the uniqueness of sites biographies and societies histories. To trace possible developments in the concepts and representations of settlement space, it is more convenient to focus on single constitutive elements and examine the structure and role of neighbourhoods, streets and open spaces.

8.5.1.2 Streets, neighbourhoods and spatial organisation

The planning and construction of streets and neighbourhoods can provide evidence of cooperation, collective actions and communal work (Banning 2010, 75-77).

In the rural villages of Early Cypriot, c. 2400-1950 BC, the lack of street plans and the agglomerative distribution of buildings suggests that individual households and groups provided the necessary labour for building construction, encouraging the idea of an egalitarian social organisation, based on an even distribution of products and goods (Peltenburg 1996, 27; Knapp 2008). The lack of status distinction is also reflected in the lack of special purpose buildings and in the absence of distinct neighbourhoods, possibly differentiated on the basis of economic status and ethnicity, as attested at other sites (Fisher 2014b, 202-203).

At Middle Bronze Age Erimi-LtP the occurrence, in Area A, of buildings aligned according to system of passageways/lanes in Area A, may possibly constitute an evidence of the existence of a street system connecting buildings and areas of the settlement. This coordinated arrangement of buildings and spaces is considered indicative of centralised planning and it is suggested to be one of the prominent aspects of the spatial configuration of LC urban centres in Cyprus (Fisher 2014b, 191-195). According to Garfinkel (2006, 103-111), communal works, such as street construction and maintenance, require supervision and coordinating authority, and, therefore, their occurrence may constitute evidence for hierarchical political systems. However, I argue that similar structures and communal decision making may also be the result of a corporate strategy, where the tasks and surveillances are distributed according to expertise,

enabling the continuity to undertake large-scale projects, as suggested by Sarit Paz (2012, 423) and Chesson (2003). Similar forms of cooperation have been also observed in the construction and maintenance activities of plaster floors and surfaces (see Section 8.4.3.4).

If the occurrence of a street system at Erimi-LtP it is still to be carefully evaluated in future excavations, the existence of distinct areas, that may possibly be compared to primitive forms of neighbourhoods, could be confirmed, as currently supported by the analysis of spatial configuration of buildings and the examination of activities carried out in the two areas of the settlement. In fact, as previously mentioned, Area A and B of the settlement are characterised by different spatial organisation and architectural elaboration, as evinced by the more regular alignment of buildings, the use of carefully dressed thresholds and multiple lime plaster floors in Area A. Integrated spatial analyses also revealed possible diverse uses of the two areas. Evidence from this thesis suggest that buildings of Area A were more apt to host public social occasions, attested by the larger size of buildings and entranceways (see Chapter 6), whereas buildings of Area B were arranged and constructed in order to provide more private rooms, where sleeping and other clean activities were carried out (see Chapter 7 and Figs 6.3 and 7.3). This distinction in use and function between the two areas is further supported by the analysis of residues of occupation and archaeological data, which show the occurrence of a higher number of prestige objects in Area A; while in Area B functional objects are principally attested as demonstrated by the analysis of chipped stones assemblage, which revealed the occurrence of a larger repertoire of multifunctional tools and blades in buildings of Area B compared to those from Area A (Bombardieri pers. comm). On the basis of the evidence mentioned in this section and examined in Chapters 6 and 7 and on the basis of archaeological analysis conducted at the site it is possible to assume that Area A, on top of the limestone hill, was used as productive and representative area of the settlement, whilst Area B, on the lower terraces, was designed as possible domestic quarter. This segregation between productive and domestic areas also characterises MC Ambelikou-*Aletr*i (Webb and Frankel 2013, 221-223) and LC *Toumba tou Skourou* (Vermule and Wolsky 1990) and, according to Fisher (2015, 203), might reflect the existence of nascent neighbourhoods.

The spatial organisation identified at MC Erimi-LtP, characterised by the placement of the representative area (Area A) on a higher position and the residential area (Area B) on lower terraces, is likely to reflect the organisation of the later LC urban centre of Alassa, on the northern area of the Kouris Valley (Hadjisavvas 1986; 1996). Here the monumental area of *Paliotaverna* was constructed on a higher position, while the non-elite domestic area of *Pano-Mandilaris* was placed downslope and built on a different alignment (Fisher 2014b, 195). I

argue that the elevated topographical position of Area A at Erimi-LtP and of *Paliotaverna* at Alassa was used to express an elevated social representation and to communicate power and economic status (Maisels 2010). An analogous setting may be observed at Maroni, where the monumental building complex, dated to Late Cypriote IIC, was constructed on the elevated zone of Maroni-*Vournes* (Manning *et al*. 2014; Manning and Conwell 1992; Cadogan 1992).

8.5.1.3 Courtyards, Open-areas and workplaces

Courtyards and open-areas are equally important in the analysis of transformations of spatial and social settings, as these are spaces of interaction and exchange, but also places of negotiation and contestation (Fisher 2014b; Stanley *et al.* 2013).

Evidence examined in EC rural settlements demonstrated that courtyards were routinely used as outdoor working spaces by mutually dependent and closely related households (Frankel and Webb 2006a, 311-313; Bombardieri 2013, 93; Coleman *et al*. 1996). However, the analysis of stratified evidence from Marki-*Alonia*, indicated that the high level of social and economic cooperation between households, which characterise the early phases of the settlement, was replaced during the EC I-II (Phase C) by a new social system, based on more complex negotiation of available territories and by an increased household privacy, as indicated by the decreasing size and importance of courtyards, the introduction of controlled access routes and of private entry passages and the development of single entry non courtyard-house (Frankel and Webb 2006b, 299-302).

A different trajectory has been observed during the later MC period at Erimi-LtP where open-areas appear to be the core of economic production and social interaction, both in Area A and in Area B. Open areas were used as large courtyards at Erimi-LtP. Integrated spatial analyses have indicated that open spaces were constructed to be in direct relation to streets, and were not limited by any fixed structures such as walls and doorways, nor by semi-fixed architectural elements; therefore, these open-spaces were designed to be accessible by anyone. The occurrence of working installations and shared facilities in these open-areas may imply that communal working activities were carried out in these places, suggesting cooperation and collaboration in the conduction of daily tasks. The face-to-face interaction, which was encouraged by activities carried out in these areas, is likely to have reinforced solidarity, enabled mutual support and shaped social identity, sense of community and place attachment (Keith 2003; Fisher 2014b, 201). Courtyards of Complexes A, B and D at the later LC Pyla-*Kokkinokremos* are characterised by a similar configuration, as they were organised in order to

be completely open and therefore readily accessible and visible from the street (Karageorghis and Demas 1984, 6-32).

At MC Erimi-LtP open-areas were an important place of aggregation and interaction, in contrast to that analysed by Fisher (2014b, 200) in LC II-III urban centres, where, he suggests, the general lack of large open publically accessible places may reflect an attempt to limit and control gathering, since these may stimulate political action and democratic practices (Shin 2009, 429).

The analysis of transformations in use and concept of courtyards and open-spaces is further important in the examination of the development of workplaces and working tasks. As sustained by Bombardieri (2013), the analysis of spatial organisation of working places may reveal significant evidence about socio-economic trajectories in prehistoric societies and supply evidence to analyse the transition from a household based subsistence economy to a more developed socio-economic system where there is evidence of supra-household production and communal decision making.

The case of MC Erimi-LtP, characterised by the segregation between the productive Area A and domestic Area B, represents well the transition from courtyards used as informal working spaces, where working and domestic tasks were equally attested, as exemplified by the EC contexts of Marki-*Alonia*, Sotira-*Kaminoudhia* and Alambra-*Mouttes* (Bombarideri 2013, 92-94), to the establishment of a formal workplace, based on possible specialised productions. In the case of Erimi-LtP, the productive Area A was presumably designed for dyeing and textile activities, as possibly indicated by archaeobotanical residues and archaeological assemblages (see Chapter 6; Muti 2015). According to the archaeological evidence analysed by Bombardieri (2013), the functional segregation of specialised working activities is further attested at other sites, notably MC I-II Ambelikou-*Aletri* (Webb and Frankel 2013), MC III Kissonerga-*Skalia* (Crewe and Hill 2012), MC Politiko-*Phorades* (Knapp 2003), suggesting a development toward the industrialisation of productions, which may be viewed as one of the distinctive traits of socio-economic system of urban societies in Late Cypriot period (Knapp 2008; 2013).

8.5.1.4 Visitor interactions and Inter site relationships

Ethnographic studies of social interaction in traditional Mediterranean societies indicate the importance of regular or institutionalised visitation among household as means of social exchange (Gavrielides 1974; Ilcan 1996; see also Fisher 2014a, 408). These occasions were important in creating and maintaining social, political and economic systems.

As it has been noted in studies of Late Neolithic Greece (Pappa *et al*. 2004; Halstead 1999), periodic hospitality or commensality on supra-household scale was of considerable social importance as they permitted pursuit of economic and political goals and negotiation of social obligations (Frankel and Webb 2006a, 315). It is not certain if courtyards of EC rural contexts served as context of interaction between household members and possible visitors. However, the longevity of the settlement and household continuity attested at Marki-*Alonia*, suggest that effective cultural mechanisms were in place to ensure the economic survival of individual households and the larger communities. As argued by Frankel and Webb (2006a, 316), movement of goods, people and livestock were also possible means to cement mutual obligation and to reinforce shared identities.

Fisher (2014a, 408-409) argues that regular reception of visitors was an important element in Protohistoric Bronze Age supra-household relations and argues that these interactions often took the form of feasts. Evidence of such supra-household scale interaction may be identified at Erimi-LtP, in the different spatial arrangement and micro-history of one of the buildings analysed in Area A: SA VI. While buildings SA I-II-II were oriented in order to face the downslope residential area and to be accessible from a street possibly in connection with the lower domestic buildings, SA VI was constructed to have a direct access to the big communal courtyard WA IV and with the eastward access to the settlement. SA VI, which was designed as open or semi-open working area during the earlier Phase B, was turned into a roofed building in the later Phase A2 and its architectonic elaboration was enhanced through the introduction of a limestone slab floor, functioning as corridor in relation with the northern entranceway during the latest Phase A1 (see Section 6.7). The internal space of the building was large enough to host around 60 standing people, based on modern architectural standards (Neufert and Neufert 2000, 16-17; Fisher 2009, 444; Fisher 2007, 101-102), as the internal space was not furnished with fixed or semi-fixed installations. In addition, the analysis of use of space in this thesis has identified and established that there was: frequent re-plastering of floor in fine white plaster suggesting emphasis on presentation of this area; a complete absence of big storage vessels; and a high number of bowls and open shape vessels, typically used for consumption. Based on this evidence I argue that SA VI probably was a representative space used for visitor interaction. This building presumably provided opportunities for the creation and maintenance of supra-household cooperative alliances, which were possibly fostered by an increase in wealth and an extra regional economic system at the end of Middle Cypriot period (Fisher 2014a, 409; Hayden 2001).

8.5.2 Socio-cultural conventions and social identity

In the previous sections I discussed the role of constitutive elements of settlements in the construction of socio-cultural settings; in this section I delineate the significance of settlement construction, use and abandonment in the definition of social and cultural identities.

8.5.2.1 To build and to abandon

The construction of built environments, including the choice of location, the site planning, the preparation of architectural materials and the construction of buildings, is a long-term project, which implies cooperation at supra-household level and involves communal decision-making. The act of building together may create new social ties and relations of reciprocity and the resulting project can be a symbolic expression of the formation of a new social group (Gerritsen 1999, 84). The planning and realisation of such long-term projects represent an act of place-making, through which the static setting of 'space' become a dynamic, socially constructed and meaningful context, where human actions and experiences and social systems are produced and negotiated (Fisher 2014a).

The task of building large projects requires a long-term commitment as well as the ability to control resources and coordinate substantial investment of labour. As claimed by Knapp (2009, 47), these undertakings cannot have failed to create a sense of group identity.

At Erimi-LtP the organised layout of settlement areas, the regular orientation of buildings and open-areas, the homogeneity in building techniques adopted in construction, using specific architectural materials may materialise the concept of uniformity and communal labour invested in the construction of the settlement. As I already mentioned (see Section 8.4.1.1), the act of cutting into the limestone bedrock floor and constructing had, together with functional purposes, ideological implications associated with the sense of immutability and continuity, but also of strength and power, which possibly fostered the connection with the natural environment, enhancing the formation of place attachment (Altman and Low 1992), and played important role in the creation of social identity (Tilley 1996; 2004, 1-33). Ethnographic observations attribute ideological significance to stones and natural features in the landscape, suggesting that these are imbued with mythical and sacred qualities, and therefore the choice of using certain natural materials may be considered as an expression of identity (Ucko and Layton 1999; see also Bukach 2003, 23). Studies of megalithic architecture also suggest that stones in their natural state held special significance, and therefore their use in architecture may have served as a kind of social mnemonic to connect people with place through visual and tactile qualities of stones (Scarre 2004a, 2004b). In the light on these observations, it is possible to presume that the choice of cutting into the limestone bedrock floor and constructing using

specific materials, was a mean by which the community communicated their own identity to a larger scale unit. At the same time the immutability of building foundations carved into the bedrock floors marked the continuity and constancy of buildings and supported the accumulation of individual and collective memories (Ingold 2000, 175). Similar concepts have been identified in LC houses, where continuity and memory are materialised through episodes of rebuilding using identical plan, and through the construction of new walls directly on top of the old foundations, as in LC IIIA houses of Area A at Episkopi-*Bamboula* (Weinberg 1983, 9-26; Fisher 2014a, 411).

Ideologies of immutability, power and social identity are embedded in the monumental architecture of later LC Cyprus. Knapp (2009, 47) sustains that monumental buildings embodied not just the materials from with they were built, but the people and experiences involved in their construction, and therefore they served to consolidate the social fabric and to express ideology, elicit memory and to constitute identities. Within hierarchical societies of Protohistoric Cyprus, monumental buildings were 'elite projects', whose construction was typically motivated by the pursuit of social status or political power, and by the capacity to develop surplus labour. In this system, builders who helped to establish elite identity and authority, inevitably would have become aware of their subordinate status (Knapp 2009). By contrast, I argue that in the earlier MC period at Erimi-LtP the concept of uniformity displayed in the buildings and the communal labour invested in the construction of the settlement were used to bridge possible inequalities and to balance social forces within the new settlement framework, and thereby facilitate the execution of large-scale projects (Paz 2012, 242; Chesson 2003, 86).

If the construction of the settlement may provide evidence of the formation of social identities, roles and status, the analysis of abandonment practice may offer significant clues to examine the way these identities are reinforced and maintained through social practices and rituals for individual households and across generation an in the longer term (Souvatzi 2008; 2012, 203).

Understanding the origin of depositional layers within buildings may play an important role in identifying the ritualised life histories of places and communities (Van Keuren and Roos 2013). Symbolic closure of structures has been identified in buildings SA I, II, III of Area A at Erimi-LtP, by means of stratigraphic observations, micromorphology and integrated FTIR analysis (see Sections 6.4.7, 6.5.8, 6.6.5, 6.7.6). Building SA III provided significant evidence of symbolic sealing, as indicated by layers of sterile sediment and re-used rubber stones that covered the eastern area of the building, where vessels and other ceramic objects were assembled (see Section 6.6.5). The concentration of objects on the last occupation floors of

buildings SA I, II, III has been interpreted as evidence of possible deliberate placing by the community before the abandonment, as part of commemorative and ritual practice, which may be seen as last act of the life of settlement (Chapman 2000, 105-106). The presence of closure ritual, as symbolic representation of the community, is further materialised in buildings SA I, II, III by evidence of burning. Building conflagration as possible form of abandonment ritual, is widely documented both ethnographically and archaeologically (see Tomka 1989; Stevenson 1982; La Motta and Schiffer 1999; Tringham 2005, Stevanovic 1997). Based on the evidence analysed, and considering that stones and mudbricks structures are difficult to ignite without any accelerant, I excluded the possibility of accidental fire and suggested that the burning and collapse of the buildings SA I, II and III, were the result of an organised and deliberate effort of 'sealing off' in order to mark the end of settlement-life and possibly to create an enduring symbolic continuation of community roles and identity on that place (see Section 6.8.3; Stevanovic 1997; 2002; Souvatzi 2008; Tringham 2005). As Cessford and Near (2006) pointed out in their study of house burning at Çatalhöyük, although fire destroys personal histories and memories, it also has transformative, purifying and renewing properties, and therefore can create new, collective memories (see also Tringham 2005, 104-8; Souvatzi 2008, 2119-220). Consequently, house construction, use and abandonment may be seen as segments of a continuous process, through which social identities, roles and statues were negotiated, displayed and maintained (Stevanovic 1997, 385).

8.6 Continuity and transformation in settlement organisation and concept of space between the Prehistoric Bronze Age and the Protohistoric Bronze Age in Cyprus.

The evidence examined and discussed in this thesis is outlined in this section and summarised in Table 8.1 in order to define the elements of transformations in ecology, buildings practices, architectural forms and settlement organisation, between Prehistoric and Protohistoric Cypriot societies. As already reiterated in this chapter, transformations and developments in socio-cultural systems cannot be traced as uni-liner processes due to the fluid and dynamic forms of societies (Souvatzi 2012). In line with this view, the aim in this section is to use the elements analysed as possible markers of socio-cultural and economic developments in Bronze Age Cyprus, without underestimating the potential complexity and diversity of evolutionary patterns, architectural biographies and socio-cultural histories. The picture sketched aims to contribute to critically assessment of the role of MC Erimi-LtP society in the dynamic development that from household-based systems lead to the formation of increasingly complex socio-economic urban forms.

8.6.1 Environment, ecology and social practices

Ethnoarchaeological studies aimed at analysing procurement strategies and accessibility to resources in ceramic production have demonstrated that while in egalitarian societies the distribution of natural resources and available territory appear not to be controlled or restricted, in response to an non stratified socio-economic system, in hierarchical societies the accessibility to natural resources was more frequently subjected to restriction and control by local authority (Neupert 2000; Arnold 2000). Analyses of Bronze Age Cypriot ceramic production (Webb 2014; Frankel and Webb 2014; Steel 2010; Crewe 2004; 2007) and studies of socio-political systems and developments (Peltenburg 1996, Knapp 2013a, 2013) indicate similar development in trajectories, with an equable distribution of materials and products during the Early phases of Bronze Age Cyprus and an increasing differentiation in resources accessibility and products distributions during the mature period of urbanisation, in LC II-III, although forms of heterarchical distribution of materials and production have also been identified in ceramic industry of LC I (Steel 2010, 108). In this picture, individual social trajectories have been also identified, as at EC Marki-*Alonia*, where forms of land appropriation and privation started to appear during the EC I-II (Frankel and Webb 2006a; 2006b).

These diverse forms of accessibility and control over natural resources reflects different systems of production and work organisation. In egalitarian rural contexts of Early Cyprus (c. 2400-1950 BC), the production was at household-level, with household members, including women and children, actively involved in the execution of building operations and other domestic and working tasks. It is argued that this system, which was based on subsistence economy, did not support the formation of specialised technical skills, although forms of 'part-time specialisation' have been identified in EC I-II phases at Marki-*Alonia* and MC Amebelikou-*Aletri* (Webb 2014; Frankel and Webb 2006a; Webb and Frankel 2013; Peltenburg 1996, 27). In increasingly complex socio-cultural systems of LC urban centres (c. 1650-1100/1050 BC), the formation of specialised skills and productions and fostered forms of technological innovation were promoted by greater establishment of socio-political power and the stratification of society, the control over natural resources, land and labour, the access to resources in demand, notably copper, and the centralised politico-economic organisation (see Section 1.3.1; Knapp 2013a; 2013b). The analysis and discussions conducted in this thesis evidenced the significant role of technological improvements in the formation of urban identity during the middle Cypriot period (see Section 8.4.2). The development of stone carving and dressing and the subsequent diffusion of ashlar architecture, may be viewed as one of the most characteristic element of innovations of urban architecture and symbol of elite control and authority (Fisher 2009; 2011).

8.6.2 Shaping building forms and social identities

The analysis of buildings forms and settings in this thesis provides significant information concerning the socio-cultural organisation of Bronze age communities. The evidence analysed indicated increasing sensible transformations, between household-based communities of Early Cyprus and urban societies of Late Cyprus.

The general picture emerging from other sites illustrates that EC settlements, such as Sotira-*Kaminoudhia* and Marki-*Alonia,* were characterised by free-standing structures with no defined size and orientation, suggesting that single households provided the necessary labour for buildings construction (see Section 8.4.3).

Architectural evidence analysed at Marki-*Alonia* indicates that the establishment of major pathways in later EC I-II phases may have involved wider communal-decision making; although there is still little evidence for settlement planning coordinated at community level (Frankel and Webb 2006a, 314). The examination of fixed and semi-fixed elements within buildings and in external courtyards at other sites suggests that domestic and working activities were routinely carried out either in inner rooms and in enclosed courtyards (Frankel and Webb 2012, 486; Coleman *et al.* 1996, 327-328; Georgiou 2008). Within this general framework, evidence of increasing privatisation and economic specialisation has been identified at Marki-*Alonia*, attested by increasing segregation and compartmentalisation of buildings space and with the gradual differentiation of working tasks in household courtyards (Frankel and Webb 2006a).

Examinations of floors indicated a general increase in maintenance and cleaning practices at Sotira-*Kaminoudhia*, Marki-*Alonia*, and Alambra-*Mouttes (*Knapp 2008, 125), suggesting the occurrence of communally shared routinely practiced activities within buildings, and possibly associated symbolic meanings, which influenced perception of these spaces and the range of behaviour in these contexts (Matthews 2005; Matthews and Ergenekon 1998).

Within less than three centuries new types of domestic and monumental buildings were constructed in urban landscapes. Protohistoric Bronze Age buildings were typically larger than they prehistoric Bronze Age counterparts and were characterised by a higher number of defined spaces (Fisher 2014a; Bolger 2003). LC structures were generally built with a similar shared orientation and were arranged according to street systems, suggesting planning at higher levels than the household, as well as and communal decision-making.

Table 8.1 Elements of transformation at Household and Settlement scale between Prehistoric and Protohistoric Bronze Age Cypriot societies.

	ELEMENTS OF ANALYSIS	Prehistoric Bronze Age	Protohistoric Bronze Age
HOUSEHOLD SCALE	ACCESS TO RESOURCES/ LAND OWNERSHIP	Unrestricted/ Little evidence of land ownership in EC I-II	Restricted/Control of land and local materials
	LABOUR ORGANISATION	Household-based	Specialised workers with distinct skills
	SCALE OF PRODUCTION	Small scale, limited to household	Large scale, surplus products
	TECHNOLOGICAL LEVEL	Not specialised and/or elementary specialisation	Advanced technical skills
	BUILDING SHAPE/SIZE	Smaller and irregular, un-oriented structures	Bigger and more regular structural plans and orientation
	ARCHITECTURAL ELABORATION	Absence of elaboration and distinctions between buildings	Ashlar architecture/distinction in elaboration between elite and non-elite buildings
	DOORWAYS SIZE/PLACEMENT	Smaller width and irregular placement	Larger width and more regular placement
	STORAGE CAPACITY	Limited capacity, restricted to household subsistence	Large capacity/production of surplus
SETTLEMENT SCALE	SETTLEMENT ORGANISATION	Agglomerative	More regular layout
	STREET PLAN	Absent	Regular Grid from LC II-III
	NEIGHBOURHOODS	Absent/less evident	Occurrence of functional segregation of settlement areas/ By LC III defined blocks aligned according to street system
	COURTYARDS/OPEN SPACES	Connected to a range of household groups	Absence of open-areas and privatisation of courtyards
	WORKPLACES	Informal: domestic and working tasks equally performed in the same space	Formal: specialisation of spaces and activities.
	VISITOR INTERACTION	Little evidence/multi-use places	Feasting and buildings to host public occasions.

In addition, analyses conducted by Fisher (Fisher 2007; 2011; 2014b; 2014c) at monumental buildings of LC Enkomi, Alassa-*Paliotaverna,* Kalavassos-*Ayios Dhimitrios* evidenced different trends in social interactions, associated with the introduction of fixed and semi fixed architectural elements, notably doorways and hearths, and an increasing aesthetic elaboration, which had its highest expression in ashlar architecture. As explicated by Bolger (2003, 49), not all of these innovations took place at every site, nor occurred simultaneously throughout the island. And, while some sites are characterised by greater degrees of standardisation and elaboration, in general ProBA buildings reflect a 'multiplicity of cross-cutting social networks, from the household through various level of community, depending on gender, age, social status and other elements of personhood' (Fisher 2014a, 413).

8.6.3 Settlement organisation and socio-economic trajectories

The analysis at the larger settlement scale further evidences the substantial transformations in organisation and concepts of space between Early Cypriot and Late Cypriot societies. If the agglomerative layout of rural EC settlements represents the results of gradual demographic growth of household groups, the more organised forms of LC urban settlements, whose best example is represented by the grid-based plan of LC II-III Enkomi, embody decisions at supra household level, communal planning and organised labour (see Section 8.5.1.1). However, as pointed out by Manning *et al*. (2014), intermediate forms of settlement organisation, which are characterised by domestic and productive areas set amid large open spaces, were constructed in the early phases of urbanism in Cyprus, during LC I, as represented by Maroni, and possibly by the earlier LC levels of Enkomi. Recent intra-site geophysical survey and excavation conducted at MC site of Alambra revealed a spatial organisation, similar to that of Maroni, with domestic and productive areas separated by vacant lands and burial areas (Sneddon 2015).

The examination of specific spatial attributes when viewed together, correlate and concur in delineating major aspects of transformations. These are principally attested in the change from a lack of communal planned spaces, such as streets, open areas and neighbourhoods in EC contexts, indicating a lack of higher level of organisation and labour investment, to the construction of new spaces of social interactions within buildings of LC urban contexts, which attests the need to create spaces for visitation and exchange at larger scale. In addition, the introduction of formal work-places, which were designed for specialised productions and activities, manifests the functional specialisation that accompanied the development of an increasingly complex economic system, which integrated staple and wealth finance (Knapp 2013a; 2013b; Fisher 2014a). In this way, Protohistoric Bronze age settlements materialised

new social systems and provided new contexts for the formation and reproduction of urban socio-cultural identities.

8.7 Erimi-*Laonin tou Porakou*: a proto-urban society?

Urban systems often represent a final point in the long-term transformation of human ways of living, and, therefore, they may include a range of stages and phases. According to studies of social geography, anthropology and archaeology (Bowman and Wilson 2011; Kosse 1994; Blanton 1976; Smith 2009; Childe 1950; Cowgill 2004; Osborne 2005) the phenomenon of urbanisation not only includes the development of urban centres and their demographic expansion; it also represents an increasing role of the built environment in mediating social relations, the construction of public spaces and structures, the importance of integrative potential of rituals and socio-cultural behaviours, changes in the social means of production and consumption and transformations in interregional interactions, exchanges and networks (Horejs 2014; Knapp 2013a).

In this final section, I examine the role of MC Erimi-LtP in the formative process of urbanism and complexity in Cyprus. In Table 8.2, I compare spatial and socio-cultural settings identified at this Middle Cypriot site, with those of earlier village-based societies of Prehistoric Cyprus and later urban societies of Protohistoric Cyprus, in order to examine possible elements of innovation in building practices, architectural forms and settlement organisation, and to identify any indication of the emergence of new systems of social organisation and socio-cultural identities.

Following the nomenclature adopted by Fisher (2014b), I classify the formative period of urbanism and increasing complexity in Cyprus as 'proto-urbanisation', whilst at the same time seeking to identify key indicators of this. This process is chronologically set between the end of Middle Cypriot and the mature phase of Late Cypriot, from MC III-LC II; c.1750-1340 BC (Fisher 2014b, 188). It is not possible to encompass the variation of proto-urbanisation systems within a single explanatory model, as evolutionary pathways are multiform and comprise contingent social, cultural and economic trajectories. However, the analysis of architectural evidence in this thesis allowed me to collect and consider new multi-proxy and multi-scalar evidence and identify a range of interesting elements and characteristics, which indicate the gradual appearance of detectable transformations in use and concept of the built space starting from MC II-III/LC I.

Table 8.2 Elements of transformation at Household and Settlement scale at MC Erimi-LtP compared to those of earlier Prehistoric and later Protohistoric Bronze Age Cypriot societies.

	ELEMENTS OF ANALYSIS	Erimi-*Laonin tou Porakou*	Comparisons with:	
			PreBA	**ProBA**
HOUSEHOLD SCALE	ACCESS TO RESOURCES/ LAND OWNERSHIP	Non restricted	X	
	LABOUR ORGANISATION	Specialised workers with distinct skills		X
	SCALE OF PRODUCTION	Communal/supra-household		X
	TECHNOLOGICAL LEVEL	Advanced technical skills		X
	BUILDING SHAPE/SIZE	Larger than EC houses and more regular		X
	ARCHITECTURAL ELABORATION	Ashlar architecture/distinction between diverse areas of the settlement		X
	DOORWAYS SIZE/PLACEMENT	Larger width and more regular placement in Area A. Smaller and irregular in Area B	X	X
	STORAGE CAPACITY	Medium capacity	X	
SETTLEMENT SCALE	SETTLEMENT ORGANISATION	More regular layout		X
	STREET PLAN	Possible presence of street system		X
	NEIGHBOURHOODS	Distinct areas within the settlement: primitive forms of neighbourhood?		X
	COURTYARDS/OPEN SPACES	Public spaces for working tasks and social interaction		X
	WORKPLACES	Formal: segregation between domestic and productive areas		X
	VISITOR INTERACTION	Spaces designed to visitor interaction (e.g SA VI)		X

The data-set extrapolated from the analysis of architectural evidence at Erimi-LtP indicates the emergence, during the Middle Cypriot period, of new social systems based on community and cooperation, and not restricted to small, individual household groups. Drawing on

anthropological, sociological and ethnographic definitions (Isbell 2000, 243-248; Yaeger 2000, 124-126; Bell and Newby 1971; Urban 1996), Knapp (2003, 566-568) describes communities as social institutions, internally well integrated and externally bounded, in which all cultural, biological and social reproduction took place. He sustains that people who belong to communities are involved in various social relations that serve to structure and define the nature, the economic base and the cultural and political ideologies of this social system (Knapp 2003, 566-568). Members of communities, therefore, develop a strong sense of place, which may represent the most fundamental form of experience, identity, and contestation (Casey 1996, 36-38).

The new form of built environment that emerged at Erimi-LtP, which is characterised by rectangular, regularly oriented buildings, organised in distinct functional areas according to a planned layout, reflects a transformative social environment, in which the organisation of space created new patterns of social, economic, and political relations, and people's identities and new forms of interaction and networks. This concept of settlement required large-scale cooperation and communal strategy, which, may imply shared knowledge, established mechanism for agreement and internal organisation. I argue that this successful cooperation was possibly facilitated by continuity of previously established identities and socio-cultural cohesion, as possibly suggested by the high level of expertise and coordination in activities such as settlement planning and limestone bedrock carving from the outset at Erimi-LtP (Paz 2012, 424).

I claim that cooperation and coordination acted as propulsive forces that enabled the development of specialised forms of production and technological improvement, as suggested by the analysis of mud-bricks and lime-plaster industries, which attest the circulation of specific recipes between members of different buildings of the settlement. Similarly to what proposed for urban forms of Early Bronze Age Levant (Chesson 2003, 86; Philip 2001), I argue that cooperation among community members was responsible for the construction and maintenance of large scale projects. Like Paz (2012, 242), who analysed the formative phase of urbanisation in Southern Levant, I claim that the communal labour invested in the construction of the settlement created a concept of integration, which enabled social forces to be balanced and was used to bridge possible inequalities. At Erimi-LtP the concept of uniformity was further materialised in the undifferentiated use of architectural materials and techniques applied in the construction of buildings of the settlement, especially during the earlier Phase B. Differences in architectural elaboration, application and use of floors and surfaces and in material culture between buildings of Area A and B have been observed. However, they are representative of

diverse functions of the two areas of the settlement, with Area A designed as productive and communal area and Area B as possibly domestic and more private area, and not indicative of differences in status and prestige between families of the community.

Innovation in use of concept of space at Erimi-LtP is further represented by the appearance of ashlar masonry during the later occupation phase A. The introduction of monolithic ashlar thresholds in buildings of Area A both symbolises an enhancement in architectonic elaboration of settlement buildings and probably expresses an increasing need for security and indication of status and differentiation in ownership or access to community products, presumably as consequence of an economic improvement at the end of Middle Cypriot (Bombardieri *et al.* 2014b). The idea of increasing need for security and control over community productions and wealth is further supported by evidence recovered during 2016 fieldwork campaign, which attest the occurrence of fortification wall around the settlement (Bombardieri pers. comm.). The appearance of fortified enclosures during Middle and Late Bronze Age Cyprus represents a crucial element in the analysis of social and material assemblage of this period, as attested by ongoing studies conducted by Eilis Monahan on fortified structures of MC-LC settlements (https://cornell.academia.edu/EilisMonahan). Further investigation at Erimi-LtP and comparative analysis with fortified structures identified in the coeval sites of the island, notably Kissonerga-*Skalia* and Maroni, will contribute to shed new light on forms of socio-economic organisation and political development during Middle and Late Bronze Age Cyprus.

The functional segregation of work activities, possibly based on semi-specialised production (Bombardieri *et al.* 2014; Bombardieri 2013) constitutes a further evidence to suggest that new forms of supra-household production and communal decision-making were emerging, together with the development of networks and exchange at regional and possibly extra-regional scale, as testified by the construction of spaces designed to public inclusive occasions and visitor interaction.

On the basis of the architectural data analysed, discussed and summarised in Table 8.2, I argue that MC Erimi-LtP developed a degree of social and economic complexity that implies a supra-household organisation, which may be identifiable as proto-urban. However, as also suggested by Knapp (2013b, 23) this community lacks evidence for hierarchical leadership and social stratification, which may be associated with early states (Birch 2013, 2), and for population scale and demographic expansion, which characterise Late Cypriot urban centres (Manning *et al.* 2014, 8; Iacovou 2007; Knapp 2013b, 32). The existing evidence at Erimi-LtP does not allow us to estimate an average population for this Middle Cypriot community; further

fieldwork investigations and integrated micromorphological analysis on off-site areas, surveys, land-use reconstruction and analysis of burial record are needed to clarify the extension of settlement area and its demographic scale. Nevertheless, considering the geomorphological characteristic of the settlement area, characterised by surficial calcareous outcrops and shallow soil horizons, I argue that land availability was perhaps too limited to support a demographic development, comparable to numbers recorded for urban centres (Manning 1993, 42-43; Manning 1998, 44-45; Postgate 1991; Knapp 2013b; Iacovou 2007). I advocate that the insufficient carrying capacity of land may be considered one of the principal reasons that caused the abandonment of the settlement (Cameron 1991, 174-175).

Despite the difficulty of finding a univocal definition for the proto-urbanisation phenomenon, it is possible to identify the appearance of communal, even if not systematic, socio-cultural and economic traits in MCII-III/LC I communities in Cyprus. New building types, characterised by larger size and more regular organisation and orientation have been observed at MC II Alambra-*Mouttes* and MC III Kalopsidha (Coleman *et al.* 2006; Gjerstad 1926; Fisher 2014a, 403). Enhanced architecture elaboration, represented by ashlar masonry, were increasingly constructed during the end of Middle Cypriot/beginning of Late Cypriot, as identified at LC I Nitovikla fortress (Fisher 2009b, 192; Wright 1992, 410). New settlement organisation characterised by different functional areas/neighbourhoods set amid open spaces is attested at MC Alambra (Sneddon 2015) and in the earlier LC I levels of Maroni and Enkomi (Manning *et al.* 2014). New concepts of communities structured around semi-specialised or specialised industries have been identified at MC Ambelikou-*Aletri* (Webb and Frankel 2013), MC Kissonerga-*Skalia* (Crewe and Hill 2012), LC I Kalopsidha-*Koufos* (Crewe 2010; Merillees 1971) and at LC Politiko-*Phorades* (Knapp 2003; Knapp 2013b; Bombardieri 2013). The making of these renovated built-environments and their use in daily practices materialise the gradual emergence of new forms of social representation and of cultural, economic and political identities.

The analysis of architectural evidence at Erimi-LtP conducted through the integration of micro-scale analysis of materials, surfaces and occupation deposits and macro-scale analysis of buildings, architectural forms and settlement organisation provided a robust new multi-proxy and multi-scalar framework with which to analyse the transformative socio-cultural and economic patterns at Erimi-LtP and offered new interesting insights into the formative process of urbanisation and complexity at the end of Middle Bronze Age Cyprus.

9. CONCLUSIONS

9.1 Summary of research contributions

This research project has successfully demonstrated the potential of architecture analysis in the study of complex socio-cultural and economic dynamics during the formation of urbanism and complexity in Bronze Age Cyprus. As a cultural artefact, architecture is a metaphor for human engagement and symbolic communication (Love 2013a, 755), and therefore architectural materials, forms and practices provide an effective data-set for analysing socio-cultural narratives and exploring the formation and reproduction of cultural identities, social ideologies and economic developments (Love 2013a, 755; Watkins 2004, Banning and Chazan 2006, Hodder 1990, 30; Fisher 2014a, Robb 2010; Bloch 2010).

The application of a multi-scalar and interdisciplinary scientific approach based on the integration of field investigations, macro analysis of architectural forms, buildings and spaces, fixed and semi-fixed installations and portable objects together with high resolution analysis of stratigraphic sequences, deposits and materials, offered a robust analytical framework with which to analyse architectural biographies and reconstruct socio-cultural histories. Middle Bronze Age Erimi-LtP provided a new and apt case-study with which to analyse the development of innovations in building practices, architectural materials and forms and settlement organisation and to examine the transition from household-based organisation of Early Cypriot communities to more complex socio-economic systems of Late Cypriot urban communities, as it has been investigated by large-scale open area investigations and enabled comparison of different sectors of the community and settlement. The multi scalar data-set generated has contributed to broadening the existing set of archaeological and architectural data in Cyprus and establishing wider comparisons with other Early, Middle and Late Bronze Cypriot communities to enable examination of continuity and transformations in use and concept of space, and related socio-cultural and economic implications, and identification of the innovative aspects that characterise the recent Cypriot Prehistory-early Protohistory in Cyprus.

On an analytical perspective, this thesis project emphasises the contributions that methodological approaches based on interdisciplinary and multi-proxy analyses, may offer to the study of past built-environments (During 2006; Matthews 2005; Matthews et al 2013). In particular, this research acknowledges the great potentials of micromorphology as a high resolution analytical tool to: 1) examine architectural materials, floors, surfaces and occupation deposits and identify artefactual, bioarchaeological and sedimentary traces of activities; 2)

reconstruct life-cycle of buildings and open-areas within the settlement; 3) enhance the interpretation of archaeological contexts and assess possible bias deriving from scarce preservation of deposits in contexts with shallow-stratigraphy; 4) provide important contributions in the analysis of taphonomy and post depositional alterations, enabling more robust reconstruction of site formation processes and settlement micro-history and resulting archaeological interpretations; 5) create a reference data-set of component and deposit types, which may support future micromorphological and archaeological researches in Cypriot contexts.

Furthermore, the thesis showcases the analytical value of integrated geochemical and spectroscopic analyses to address specific research questions and to support the reconstruction of social practices. For example, XRF analysis conducted on mud-bricks, earthen constructional materials, ceramic samples and local natural sediments allowed examination of the role of access to resources and manufacturing processes in the formation and reproduction of socio-cultural identities and endorsed the importance of analysis of ecological practices and human-environment inter-relationship. Analyses conducted at Erimi-LtP have demonstrated that selection of resources and building materials is not only dictated by immediate availability and convenience, but also determined by cultural choices and social restraints. The application of FTIR analysis to characterisation of plaster materials enhanced the study of technological development and specialisation of working tasks at the site by enabling the distinction between fired and unfired-lime plasters and identification of pyrotechnology in the production of lime-plaster types. FTIR analysis also enabled more in-depth examination of complex post depositional pathways, whose identification fostered the analysis of buildings micro-history and enhanced the archaeological interpretations on abandonment practices occurring at the site and associated socio-cultural significance. The application of micromorphology and integrated micro-analytical techniques has further contributed to improve the set of macroscopic evidence, deriving from the application of spatial analysis and from the examination of geometric and syntactic attributes of the built-space.

As already demonstrated by Fisher (2007; 2009; 2011; 2014a; 2014b), the use of space syntax analysis also provides a means of investigating the materiality of past built environment, allowing significant insights into the connection between people and places in which they lived, and wider social implications of this relationship. Despite criticisms about the application of access analysis to prehistoric contexts, due to partial preservation of evidence and quality of available data (see During 2006, 32-33; Cutting 2003, 18-19), the use of an integrated spatial analysis at Erimi-LtP validated the effectiveness of this analytical method. Its application

enabled the analysis of internal layout of individual buildings and the relationships between groups of buildings, allowing collection of important information about the use and interaction within the built space at larger scale.

From a theoretical perspective, the analysis of architecture provided an effective framework to examine the formative process of urbanisation and complexity in Cyprus, by delineating aspects of transformations at household and settlement scale at MC Erimi-LtP through comparisons with other Bronze Age Cypriot contexts. Despite the difficulty of finding a univocal definition for the proto-urbanisation phenomenon, it was possible to identify the appearance of communal, even if not systematic, socio-cultural and economic traits in MCII-III/LC I communities in Cyprus, as attested by the increasing construction of new building types, and new changes in organisation of settlements, characterised by more regular layout and by an increasing segregation of working and domestic areas. The making of these transformative built-environments materialised the gradual emergence of new forms of social representation and of cultural, economic and political identities, which I have characterised as proto-urban, as they are conceptually different from household-based systems of Early Cypriot societies and characterised by spatial and social settings similar to more complex socio-cultural and economic systems of Late Cypriot urban societies. The examination of architectural evidence at Erimi-LtP evidenced the emergence, during the Middle Cypriot period, of new social systems based on community and cooperation, and not restricted to small, individual household groups. In this 'community system', cooperation and coordination acted as unifying forces, which enabled the balance of social tension and was used to bridge possible inequalities.

With regard to the initial aims, the analysis of architectural materials, technologies, buildings and settlement space conducted at Erimi-LtP has permitted me to shed new-light into the dynamic scenario of social complexity during Bronze Age Cyprus, contributing to delineation of a range of potential avenues for studying evolutionary pathways and socio-cultural trajectories, by using architecture as a key data-set of cultural evidence.

9.2 Future directions

The rewarding results obtained by combining field examinations, micromorphology, artefactual analyses and high-resolution spectroscopic and geochemical analyses indicate the potentials of this interdisciplinary multi-scalar methodological approach in future research at Erimi-LtP, and Cyprus more widely. The application of integrated field and micromorphological analyses on depositional sequences in future fieldwork investigations would enhance: 1) the analysis of formation processes and spatial and temporal variation in use

and life-histories of space in buildings and open-areas through the examination of depositional sequences in the field and combined high resolution analysis of selected stratigraphic sections by means of thin-sections; 2) the production of an accurate and detailed data-set and the subsequent formulation of more reliable archaeological interpretations and reconstructions.

In future fieldwork campaigns, micromorphology will be also applied to the analysis of off-site areas in order to examine possible traces of activities in peripheral areas of the settlement, and therefore, improve the reconstruction of spatial and social settings at MC Erimi-LtP.

Micromorphological analysis will be integrated with ultra-high resolution micro-contextual analysis of the chemical, elemental and mineralogical composition of the diverse artefactual bioarchaeological and sediment remains, within their precise depositional context in thin-sections, using Micro-IR and Micro-XRF. The application of these micro-contextual analyses will enhance the identification of source of materials and properties of surfaces and occupation deposits and will support the analysis of complex depositional and post-depositional processes occurred at the site.

Future research will include phytolith analysis in the existing set of analytical studies applied at the site. The identification of plant remains, which constitute one of the principal residues from human activity, will improve the analysis of human-environment inter-relationship, providing an important support for micromophological analysis in the study of use of space and in the reconstruction of past activities.

Future research and fieldwork will be also aimed at improving the analysis of architectural materials and technology through:

1. The collection of new mud-bricks, earthen constructional materials, and natural sediments, and related XRF data, in order to create statistical models in support of provenance studies.
2. The compositional analysis of a larger set of ceramic samples, to be used as comparative evidence to the study of architectural materials, in order to improve the analysis of ecological practices, manufacturing techniques and technological development in these two local industries.
3. The application of micro-IR and micro-Raman to analyse painting layers in order to support the preliminary data-set produced for this thesis. Natural sediments of ochre and umber will be selected from the sulfidic deposit of Troodos, to be compared with results from archaeological materials in order to enhance the analysis of social, symbolic and ritual practices related to procurement, production and use of pigments.

4. The application of new analytical methods based on FTIR grinding curves and angle-dependant XRD peaks width (Xu et al.2015) to enhance the analysis of plaster technology and identification of fired-lime in particular. Furthermore, it would be interesting to produce experimental plasters as reference materials to evaluate the alterations of calcite exposed to elevated temperatures (Chu et al. 2007; Regev et al. 2010a; 2010b).

Further potential avenues of investigation may include ethno-archaeological research in the southern region of Cyprus in order to examine variation in traditional building materials, formation processes, uses of space and ecological practices, which would contribute significantly to a range of a key issues, including the study of building material sources, the organisation of building practices and the human-environment relationship.

Together with contextual analysis at settlement-scale, future research could be enhanced with the application of larger scale analysis. The study of proto-urbanisation and development of social complexity in Cypriot Bronze Age societies could be conducted integrating examination at community level with analysis at regional-scale through combined macro and micro analysis on materials, technologies, architectural forms and social practices. This will enable analysis of patterns of transformations in socio-cultural and economic systems during Bronze age Cyprus within a circumscribed regional context. In this regard, the Kouris Valley area offers an ideal context to study complex socio-cultural developments during Bronze Age Cyprus at larger scale. Archaeological investigations conducted by the Department of Antiquity of Cyprus and by foreign Institutes of research and Universities, have revealed patterns of intensive occupation in this area since the Neolithic period. Even though this last objective will require long-term planning, its application may have a number of important implications for future studies concerning socio-cultural and economic developments during Bronze Age Cyprus.

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