ARCHAEOLOGY IN THE SMALLEST REALM

Micro Analyses and Methods for the Reconstruction of early societies in Cyprus

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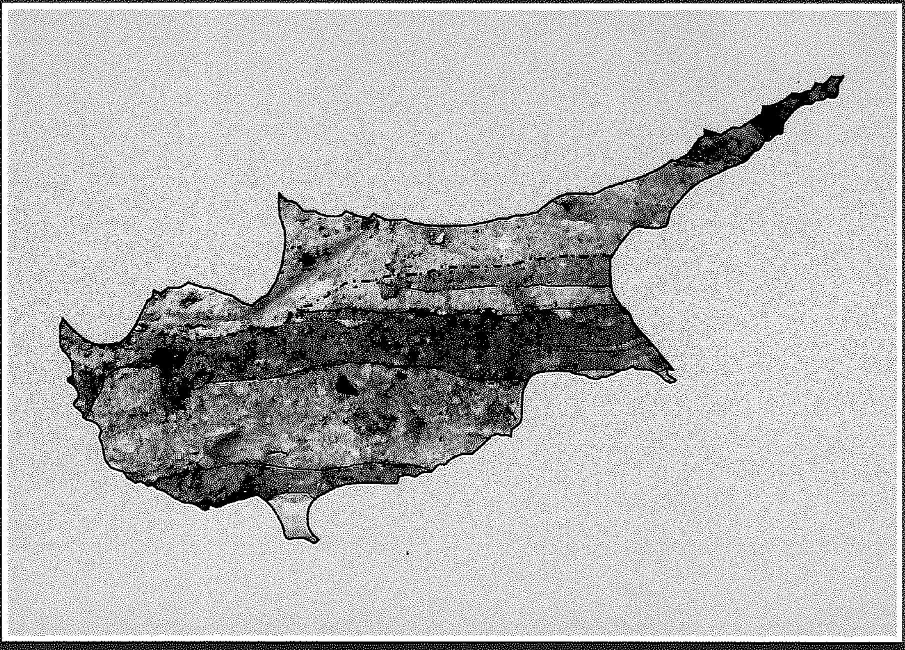

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Building function through micromorphology of floors at Chlorakas-*Palloures*, Cyprus

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Abstract

The organization of the household and settlements in Chalcolithic Cyprus is traditionally reconstructed through the functional analysis of floor level finds and architectural characteristics such as building size and spatial conventions. The available data set is unfortunately biased towards a few well-preserved, rich contexts, as most excavated buildings are only partly preserved, with few floor level finds. From many buildings only fragments of walls and floors were found. As constructed floors may yield information about the original function of a building, their precise characterization may help in identifying the functional nature of even the fragmentary preserved buildings. At *Palloures*, recently excavated Chalcolithic floors were sampled for micromorphology to define the materials and methods used in their construction. Results show that floors were made with a variety of tamped earth, clay, limestone and burnt lime recipes. In this paper, the floor types are described and related to the other functional aspects of buildings they were discovered in.

Keywords: Chlorakas-*Palloures*; Chalcolithic Cyprus; Micromorphology; Prehistoric floors; Building function

Introduction

Chalcolithic settlements in Cyprus are characterized by a seemingly unchanging tradition of uniform round domestic buildings with a diameter between three and fourteen metres, averaging around six metres. The walls were built with a stone base and a mud superstructure, and the buildings typically contained a central hearth and a single entrance. The standard round house is thus considered the dwelling for a nuclear or extended family and it contained separate activity areas for domestic use, storage, food preparation and crafts such as tool production (Peltenburg *et al.* 1998: 237-40; Papaconstantinou 2013). Although the model is based mainly on the evidence from a few well-preserved buildings, the recurring standard building layout has been thought to represent an egalitarian societal structure (Knapp 2013: 204-6).

Some discovered buildings deviate from the proposed model of a standard round house. Several rare rectangular structures at Kissonerga Mosphilia, for instance, have also been associated with a domestic function (Peltenburg *et al.* 1998: 35). In contrast, rectangular Building 7 at Lemba Lakkous measures 3 x 4 metres and contains a large complex of plaster basins, probably used in conjunction with grinding stones, and is interpreted as a specialised food processing unit (Peltenburg 1985: 121-123; Papaconstantinou 2013: 151). The limited remaining space in the building would not allow for a parallel use of this building as domicile. Parallel to the round house, at least one other building shape therefore exists, rectangular, in varying size and function (Papaconstantinou 2013: 141).

Among the circular buildings, there is a notable variety in size. Buildings with a diameter of less than 2 meters do not offer the space which was required for the habitation by a household group and the domestic activities which are suggested to have typically taken place inside (Peltenburg *et al.* 1998: 237). The discovery of buildings with a diameter of over 12 meters also disagrees with a notion of household equality, and have indeed been linked to incipient social hierarchies and to a centralized ritual economy (Peltenburg, 1991; 1993; Peltenburg *et al.* 1998: 253; Schubert 2018). Throughout the Chalcolithic changes in the use of buildings, such as an increase in internal storage and agglomeration of structures, are also observed (Peltenburg 1985: 320; Papaconstantinou 2013: 133-6). Taken together, buildings varied within settlements, as well as through time.

To appreciate these diachronic patterns properly, it is vital to characterize the function of individual structures. Most excavated examples are poorly preserved and do not yield floor-level finds, commonly used to explain which activities took place in a building. The evidence is largely limited to the architectural remains of walls and floors. As the foundational setting for all indoor activities, floors differ in material, strength and outward appearance related to their expected use. Their detailed characterization could therefore help in determining patterns in building function (Matthews 2003; 2005; Milek 2012; Amadio 2018; Borderie *et al.* 2020).

Floors of Chalcolithic Cyprus

In an overview of construction materials and techniques of Chalcolithic Cyprus, Thomas (2005) discerned five floor types based on macroscopic field observations at Kissonerga-Mosphilia, -Mylouthkia and Lemba Lakkous (Peltenburg 1985; 2003; Peltenburg *et al.* 1998; Thomas 2005). Thomas (2005) recognizes earth (type 1) and clay (2) floors, made from tamped or beaten soil or clay, sometimes covered by a thin lime wash. Next, the 'lime plaster floor' (3) is based on the presence of a lime plaster of up to six millimetres thick. Uncommon types are the several centimetres thick 'lime plaster platform floor' (4) and the 'cobbled surface' (5). The typology explains some obvious patterns but it is rigid and disregards potential multi-layered floors with floor packing, base layers and renovation coats.

What during excavation is macroscopically recognized as a 'floor' may in fact be a complex sequence of packing layers, structural layers, coatings, occupational debris, trampling episodes, renovation phases and post depositional alterations and thus warrants thorough analysis (Gé *et al.* 1993; Karkanas and Efstratiou 2009; Karkanas, & Van de Moortel 2014). Micromorphological and geochemical studies offer ideal approaches to characterize the precise nature and provenance of the building material, post depositional processes which impacted the floor and aspects such as the presence or absence of lime (Amadio 2018; 2019; Karkanas 2007; Matthews 1995; 2003; 2012; Matthews & Asia 2009).

Floors of Chalcolithic Cyprus have thus far only been investigated macroscopically, save for the study at the Chalcolithic settlement of Souskiou Laona. At this site, the micromorphological study of one building revealed a complex sequence of clay plasters, a single calcareous white plaster, and red ochre (Dalton 2019). Accumulated refuse in between floor layers indicate that the building was at least temporarily abandoned in between separate floor phases. The microscopic evaluation of the excavated surfaces thus enabled a more refined description of floors and effectively problematizes the earlier typological framework. Studying Chalcolithic floors microscopically is therefore worthwhile and feasible.

For the current study, floors of buildings from the Chalcolithic settlement Chlorakas-*Palloures* (hereafter *Palloures*) were sampled for micromorphology to determine the materials and methods they were constructed with. A secondary aim was to reconstruct sequences of microstratigraphy and post-depositional processes. The resulting floor types are compared to possible functional differences between buildings to observe patterns between floor type and building function. Such patterns could help interpret the functional characteristics of fragmentary preserved buildings, where no floor level finds or other features are available for this purpose.

The Chalcolithic settlement of Chlorakas - *Palloures*

The Chalcolithic settlement at *Palloures* is known since the first surveys were conducted in the area in the 1950's (Hadjisavvas 1977; Düring *et al.* 2018a). Archaeological material from the Middle and Late Chalcolithic were found in an area of around 5 Ha. In 2015 rescue excavations were commenced by a team from Leiden University led by dr Bleda Düring. In a plot of around 50 by 100 meters, divided in two areas (north and south), 17 trenches totalling 810 m2 yielded the remains of 15 Chalcolithic buildings (Figure 3.1). Following five radiocarbon dates, the structures are dated between 3000 and 2600 BCE, at the start of the Late Chalcolithic (Düring *et al.* in press).

The northern trenches yielded the remains of five buildings, which largely conform to the known Chalcolithic architectural tradition of domestic round houses with a central hearth and a single entrance. Most were too poorly preserved to offer more details. An exception is the impressive "Building 1" which,

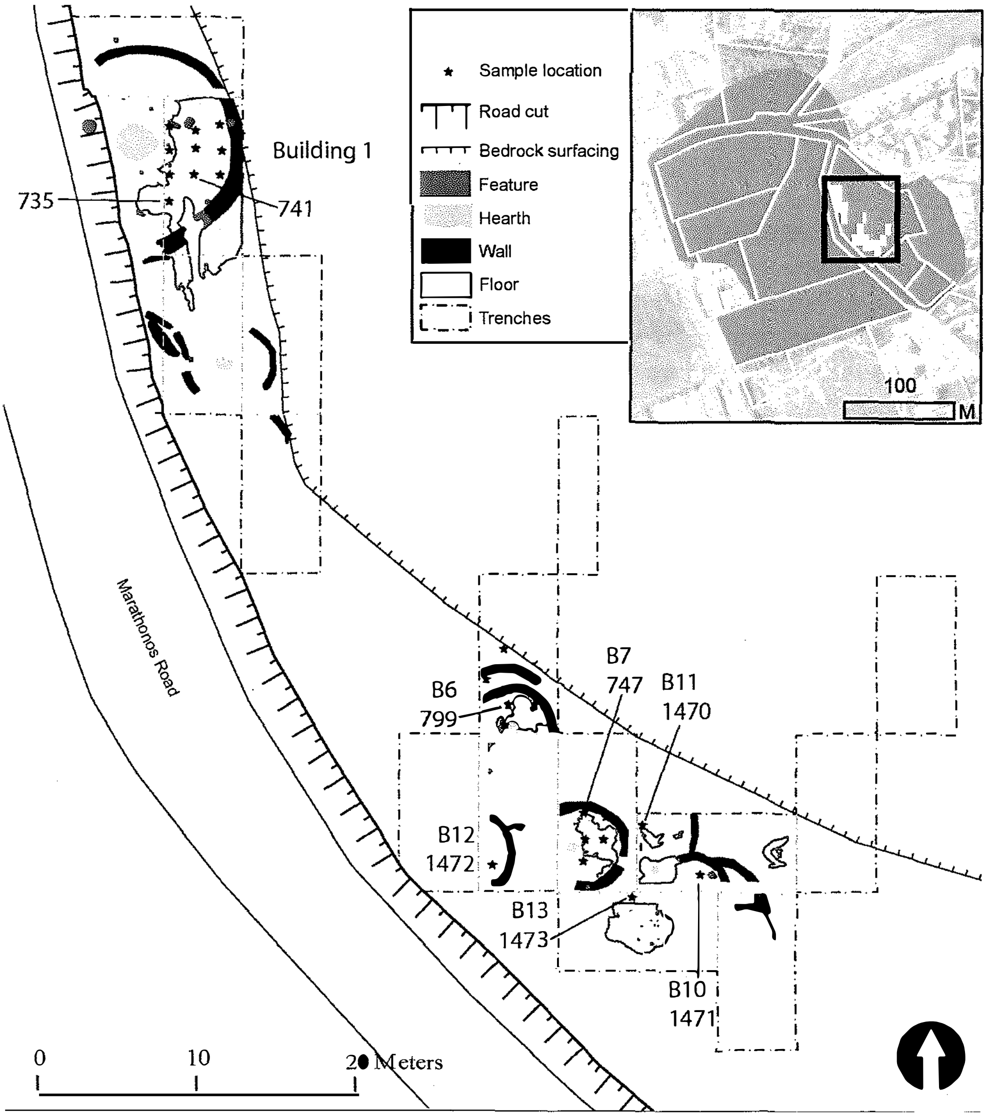

Figure 3.1: Overview of excavated remains at Chlorakas-*Palloures*, with sample numbers and building numbers (B). The inset illustrates the extent of the surveyed site in grey and excavated trenches in white.

with a wall thickness of one metre, an internal diameter of 14 metres and a central hearth platform measuring two metres in diameter, is one of few known Chalcolithic buildings of such monumental proportions (Klinkenberg 2017). The building was fitted with a two centimetre thick white plaster floor which ran outside to a portico area. After the period of use of the building in conjunction with the thick plaster floor, a soil layer of varying thickness was deposited.

On top of this soil, trampled surfaces and floor patches were discovered. These displayed evidence of fire and their overall untidy appearance caused them to be described during fieldwork as a 'squatter's phase'.

The southern trenches yielded the deeper stratified remains of ten buildings in varying degrees of preservation. Most buildings conform to a diameter between four and six meters, with a wall thickness of around 40 centimetres. Building 12 is remarkable in that its wall is entirely made of stone and preserved to a meter in height. Of Building 13 no walls were found, and it appears to have been a dug-in structure for at least half a meter. Also remarkable was the discovery of a group of artefacts, including a copper axe, inside a jar which was buried into the floor of Building 6, possibly as ritual cache (Düring *et al.* 2018b). A cache of ground stone tools in Building 7 was interpreted as the abandoned storage of a tool manufacturer, parallel to similar contexts from Mosphilia and Laona (Peltenburg *et al.* 1998; 2019). Of Building 10 only a small part was excavated and so no functional characteristics could be determined for this structure. Building 11 was badly damaged by later constructions and ploughing but yielded the remains of an oven structure, possibly used in food preparation.

The buildings of Palloures thus fit within the known Chalcolithic corpus. Most conform to a postulated standard of round architecture with a partial floor and a central hearth. Building 1 has extraordinary proportions but, remarkably, demonstrates the layout and architectural features reminiscent of the standard house model. Whether its impressive size signifies that it was used as communal centre or as the residence of a local elite cannot be established merely by its size. A lack of finds from the floors of most buildings also complicates their functional interpretation and differentiation. But, on the basis of architectural characteristics, a clear distinction can be made between the monumental structure (1), the seemingly conventional buildings (6, 7, 10, 11), the stone building (12) and the dug-in structure (13). This sample thus allows for an exploration of both the ordinary and the outliers in the roundhouse-spectrum.

Sampling procedure

At Palloures, several floor types were recognized inside the buildings during excavation. These were identified as hard, smooth surfaces, brown or white in colour. Without exception, these surfaces were only partially preserved, often in separate patches. The field description followed common macroscopic descriptors of colour, texture, consistency, and constituents. Loosely based on the work by Thomas (2005), a differentiation was made between earth, clay and lime floors.

Many buildings contained multiple use phases, separated from each other by thick soil layers. Where these were sampled, they are given separate floor numbers in chronological order, from oldest to younger. If in a sample separate floor layers could be recognized with no, or less than a centimetre of soil in between, these are considered in this paper to be renovation phases of the same surface.

At *Palloures* samples were obtained from all seven buildings which yielded a recognizable floor. To investigate differences within buildings (not discussed in this paper), floor level deposits were sampled in a grid in Buildings 1, 6 and 7. For these samples a column of sediment was left in place on grid points, while excavating down towards floor level around them. After reaching the floor, the sediment columns containing the floor and overlying sediments were trimmed by trowel, wrapped in plaster of Paris and extracted. Samples from Buildings 10, 11, 12 and 13 were obtained during what was thought to be the final excavation season. Under threat of future demolition of the site, gridded sampling was abandoned in favour of speed and ease of excavation. Instead, for these buildings, samples were cut out of the profile section before wrapping them in plaster bandages.

All samples were transported to the lab of the National Heritage Agency of The Netherlands in Amersfoort for thin section preparation. The samples were impregnated with colourless resin, left to harden, cut in blocks and pasted on glass plates. These were cut, lapped and polished to a thickness of 30 ⊠m, the standard for micromorphology.

The resulting thin sections were investigated using a Leica DM 2500p polarizing microscope using plane polarized light (PPL), cross-polarized light (XPL) and oblique incidence light (OIL) under magnifications between 4x and 64x. The observed sediments were described using standard terminology for micromorphology (Courty *et al.* 1989; Stoops *et al.* 2010; Karkanas & Goldberg 2019). Each thin section was scanned using a flatbed slide scanner at 3200 dpi to aid macroscopic observations and as a basis for illustrations of the thin section.

Microfacies

The observed layers in thin section were classified based on mineral composition, texture and microstructure into microfacies (Goldberg and Macphail 2005). These microfacies are typical for the current set of samples and may be refined or lumped as research progresses. An abbreviation of each microfacies is offered in bold in brackets.

The floor materials that could be distinguished are massive compacted soil (**MCS**), platy compacted soil (**PCS**), clay (**C**), red clay (**RC**), and calcareous materials such as limestone and carbonated quicklime, grouped into one microfacies (**L**). Together with the heavily bioturbated heterogeneous loose brown soil (**BS**) these materials occur in complex sequences, without a clear pattern of superposition.

All thin sections from *Palloures* are characterized by the presence of a floor or surface in conjunction with brown soil and bioturbation features created by plant roots and by burrowing animals such as worms. The brown soil (**BS**; Figure 3.2 & 3.3) is an unsorted mixed deposit of building and occupation debris, containing artefacts, plant remains, coprolite fragments, and is generally heavily bioturbated, resulting in a very loose microstructure. At present this is the only non-floor microfacies recognized in thin section.

The term massive compact soil (**MCS**) is used for areas with a generally massive microstructure and with greater compaction than the general loose brown soil (**BS**). The **MCS** matrix can consist of fine to coarse sediments including materials such as occupation debris and is often unsorted. Massive compact soil does not display internal layering or orientated clasts and voids, and was likely deposited in a dry state, possibly in a levelling process. These layers are in some cases overlain with a thin plaster and thus formed the main floor body. In other cases, the compact soil is directly covered by a clay or lime layer and may have functioned as a floor base.

Platy compacted soil (**PCS**; Figure 3.3, photomicrograph 3) occurs as 2-10-millimetre bands of fine sediment with clear horizontal orientation of elongated clasts and lenticular voids. The microstructure is platy and massive, but some internal layering can be observed throughout. In some cases, thin shrink fissures occur perpendicular to the layer orientation but most voids are elongated vesicles indicating that the soil was wet during application (Cammas 2018: 163; Karkanas and Goldberg 2019: 129). Rather than the result of levelling process in which the already present soil is redeposited, the soil for these layers was selected, mixed and wetted before application to the ground surface (Lisá *et al.* 2020a). The compaction and platy microstructure indicate that the floor was compacted through deliberate tamping of the surface or through trampling (Milek 2012: 134; Cammas 2018; Lisá *et al.* 2020b; contra Thomas 2005: 48). Although these features of a 'beaten earth' floor are often related to non-constructed trampled surfaces (Macphail *et al.* 2004; Banerjea *et al.* 2015; Karkanas and Goldberg 2019: 146), in this case they are found in a constructed floor.

Clay layers (**C**, Figure 3.2) are similarly structured as compact soil with internal layering and related orientation of elongated clasts and voids, but their matrix is mainly composed of clay, while some fine silt and fragmented artefacts or other occupational dirt may be mixed in. They are light orange to reddish in colour and generally reveal more shrinkage fissures yielding a globular pattern or, in extreme cases, partly due to bioturbation, an aggregate structure.

Red clay layers (**RC**, Figure 3.2, photomicrograph 1 and 3) are clearly distinguishable by their bright red appearance in PPL and occur as fragmented peds on the surface of a lime floor in sample 1471 and as a three millimetres thick clayey floor layer on top of the sequence in sample 799 (Figure 3.2). The red colour is likely derived from ochre which is a known colouring agent used in these contexts (Peltenburg 1998: 40; Thomas 2005: 120; Dalton 2019). From field observations at Kissonerga Mosphilia, the use of ochre is interpreted as paint or staining agent to colour the surface of floors and walls, rather than being mixed in the floor material (Peltenburg *et al.* 1998; Thomas 2005: 49). Paint layers were not observed in the thin sections or during fieldwork at Palloures.

Limestone occurs as rock fragments, crushed and powdered rock, and as processed quicklime. It is locally available, as the site sits on calcareous bedrock. The term lime is often used as a generic term for white calcareous floors and plasters but in the strict sense is reserved for floors made with quicklime (Karkanas 2007). Quicklime is produced by heating crushed calcareous rock. When this material is mixed with water (slaked) and left to dry, the quicklime is recarbonated and solidifies in place. Pure lime floors are well cemented but may be brittle, and often lime is used as the binding agent in conjunction with soil and other aggregates (*eg.* Karkanas 2007). At Palloures, lime is mainly used with crushed and powdered limestone, and although some occupational dirt such as charcoal particles may be present, the floor layers produced with these materials appear fairly clean in thin section and measure between 1 and 20 millimetres in thickness. The term lime floor (**L**) is used here in a general sense for floors and floor layers produced with limestone or any of its derivatives.

Thick lime floors such as those observed in Building 1 (Figure 3.3) consist of a dense matrix of well cemented pale grey to blue grey (PPL) cryptocrystalline calcareous material. The overall appearance is massive with shrinkage voids around dense clasts such as fossils, rock fragments, artefacts and soil aggregates, which yields a wavy globular microstructure, particularly in areas where smaller clasts are embedded such as in the lower part of sample 735 (Figure 3.3). While the majority of the mixed material is limestone derived, micro-artefacts such as lithic and ceramic fragments occur throughout (Figure 3.3, photomicrograph 2). Due to its thickness, the floor of Building 1 forms a strong, well-cemented mixture of fine material and large aggregates, even if these are over a centimetre in size. Thinner floors (4-10 mm) made with the same material (Building 7 and 10) appear more fragmented, as the binding matrix does not fully encase the larger clasts. From the surface these floors would have had a cracked or patchy appearance. Thinner lime layers yet (1-3 mm) occur on top of earth and clay floor bases, and probably functioned as a plaster. Rather than a plaster wash, thin lime layers also occur as coarse lime lumps spread over a surface. Whether these layers of fine lime versus the layers of coarser lumps denote different plaster types, or whether they represent opposite extremes on one spectrum is not yet clear.

In all but one sample (1470, Building 11) at least one finishing wash was attested on floor surfaces. Coating layers measure less than a millimetre and consist of lime and/or clay. Consecutive finishing layers are often observed, denoting renovation phases. Occupational dirt and micro-artefacts trapped in between separate coats were observed in some cases (Figure 3.3, photomicrograph 1). No clear evidence of bedding of organic materials was observed in any of the sampled floors. Fragmented phytoliths are an abundant feature in the brown soil overburden deposits (**BS**) and thus are well preserved in these soils, they are however absent from the floor layers, and therefore unlikely to have been used abundantly as temper. If any matting was used as floor cover these must have been removed before abandonment.

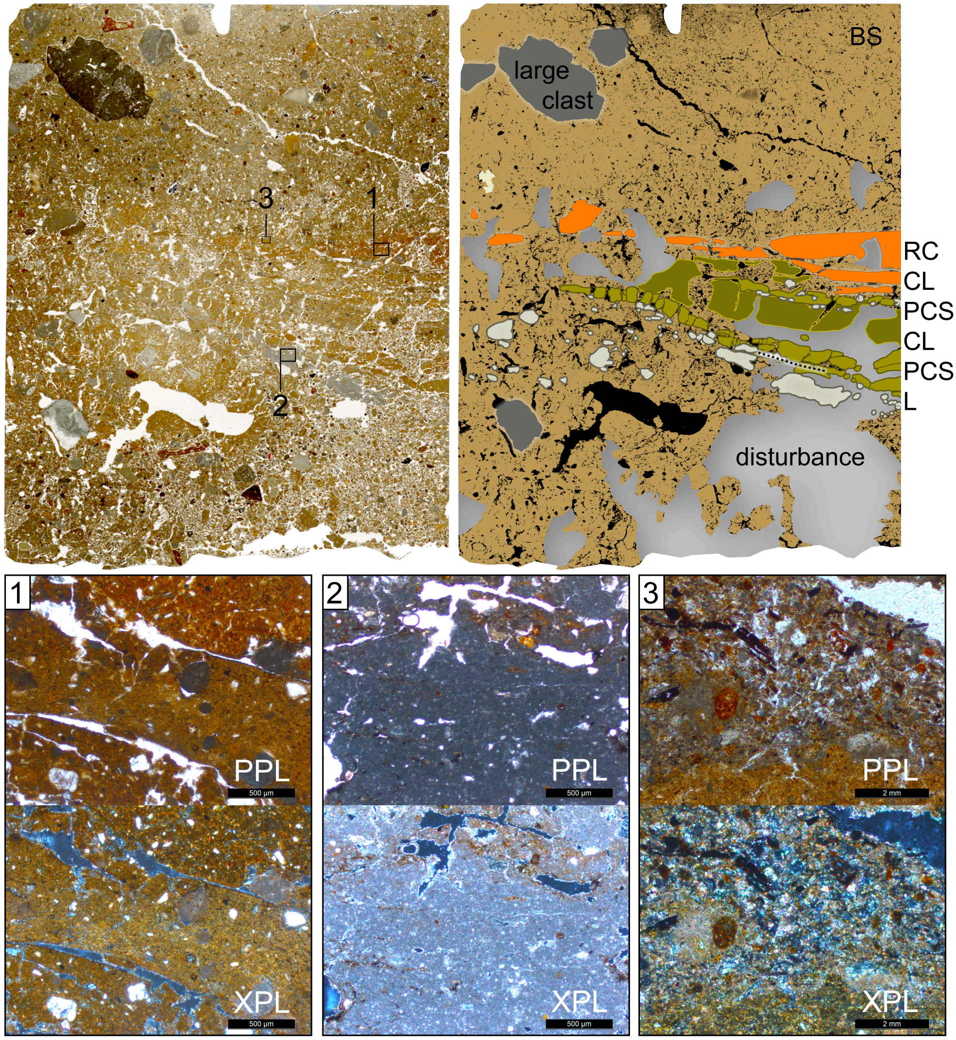

Figure 3.2: Scan and sketch indicating the primary elements of thin section 799 from building 6, height 75 mm. The floor sequence comprises of lime (L), platy compacted soil (PCS), clay (C) and red clay (RC). Photomicrograph 1 illustrates the fine clay of the uppermost (RC) floor layer. Photomicrograph 2 shows the fine lime material used for the lowermost layer, and exhibits some internal horizontal layering. Photomicrograph 3 shows the top of a clay layer with ash and microcharcoal deposited on top.

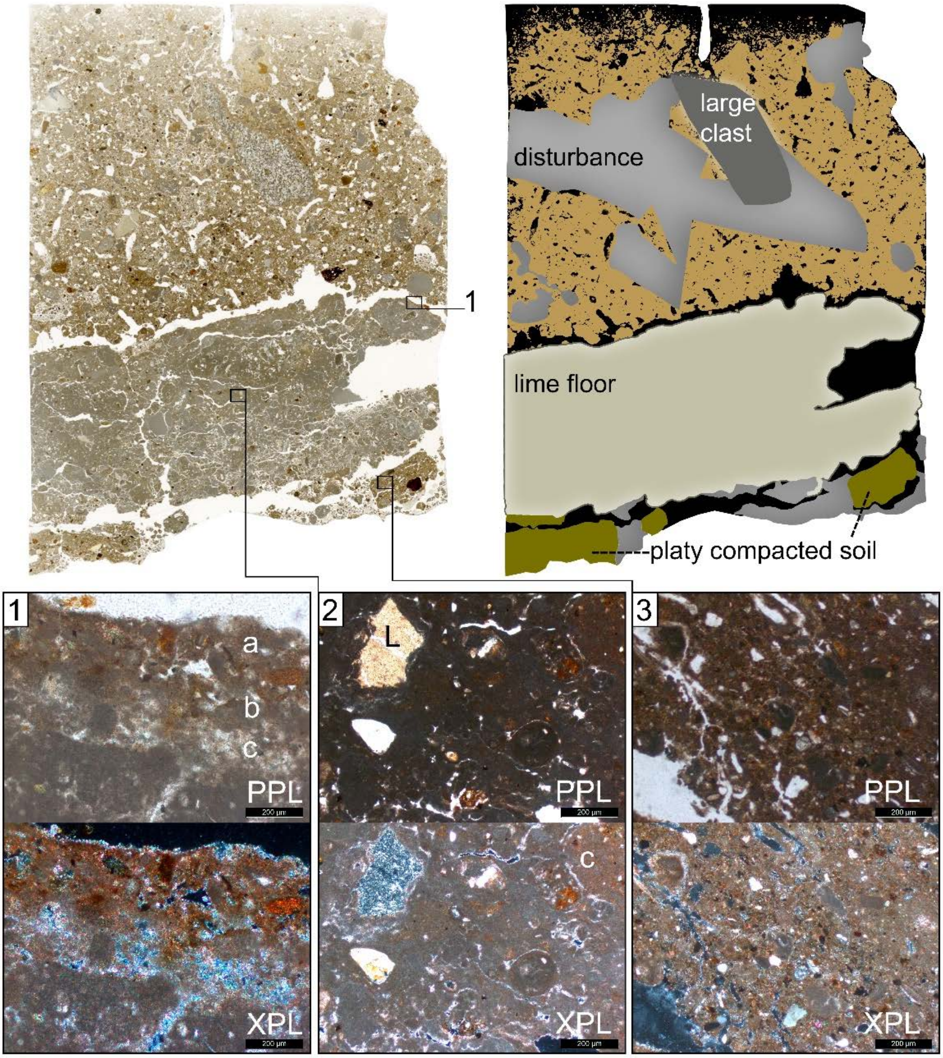

Figure 3.3: Scan and sketch indicating the primary elements of thin section 735 from building 1, height 75 mm. Photomicrograph 1 illustrates the top of the lime floor and two fine lime plaster finishes (a & b) and an ashy occupation layer (c). Photomicrograph 2 exhibits lithic (L) and ceramic (c) inclusions in the lime floor body. Photomicrograph 3 shows a typical example of platy compacted soil (PCS), with parallel oriented clasts and platy voids.

Floor sequences

Each sampled building at *Palloures* yielded a sequence of constructed surfaces in thin section. Where these floor layers were deposited directly on top of each other, for the purpose of this paper, they are considered multiple renovations of a single floor. This is the case for the floor layers observed in Buildings 6, 7, 10 and 11. If multiple floors existed in these buildings, they were outside the extent of the thin sections, which for these buildings measure around eight centimetre in height.

In Buildings 1, 12 and 13 the sequence of floor layers was interrupted by loose brown soil, denoting potential gaps in occupation (Figure 3.4). In Building 1 the floors were preserved in patches, and the two successive floor sequences were sampled in two separate soil columns. Due to the uneven floor elevation in this building, it is unclear how far apart the two floor sequences in Building 1 were. In Buildings 12 the entire floor sequence could be observed within a single thin section, while the monolith from Building 13 was processed into four overlapping thin sections, totalling 30 centimetres. In total, eleven floor sequences were recognized in seven sampled buildings (Figure 3.4).

Floors contain between one and six single-component layers of compacted soil, clay or lime. No mixing of components is observed, so no lime was used in any of the soil or clay layers for instance. Four floors are composed of only a single layer of compacted soil, three massive, one platy. All other floors comprise

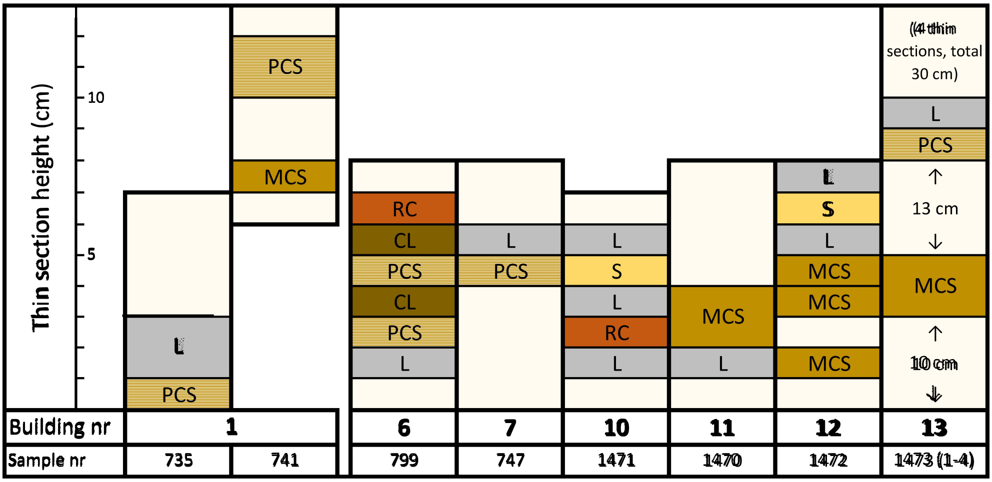

Figure 3.4: Schematic representation of floor sequences in microfacies at *Palloures* with approximate thickness of layers rounded to centimetres. Each column represents the sampled floor sequences in a thin section from one building. Building 1 yielded two thin sections with uncertain overlap, and Building 13 yielded four overlapping thin sections, here presented as one column. Empty cells represent a hiatus in floor construction and the deposition of brown soil (BS). CL = clay; L = lime floor; MCS = massive compacted soil; PCS = platy compacted soil; RC = red clay; S = unspecified soil layer.

multiple layers of varying materials. Sample 799 from Building 6 (Figure 3.2) is unique in that it yields at least six consecutive layers of lime, clay and platy compacted soil. It is also the only location which yielded clay floor layers.

The other multi-layered floors are composed of two to three layers (with additional thin lime layers on top of 10 and 12.2). It is unclear whether these floor deposits can be divided into base- and covering layers, or they represent separate use phases. Lime floor layers for instance are mostly encountered as covering layers, with a thickness of around one millimetre, which could indicate they were part of a single construction event. Samples 1471 and 1472 even show evidence of multiple reapplications of this millimetre-thick coating, separated from each other by fine sediment. In other cases, a lime layer was directly overlain by other floor layers. Because lime layers are observed in thin section as plasters, it could be expected that lime layers represent the top of a floor, and that subsequent layers represent later use phases. The possibility that calcareous materials were sometimes used as a base layer for some clay and compacted soil floors can, however, not be rejected.

Building biographies

A distinction was made between four architectural types at *Palloures*. All buildings fit roughly in the known tradition of Chalcolithic Cyprus, and four buildings are, out of a lack of detailed information, characterised as 'conventional building' (6, 7, 10, 11). Building 1 stands out due to its monumental size and construction quality. Building 12 is unique due to its stone wall construction, and Building 13 is a dug-in structure for at least half a metre. Below, the type and sequence of floors is discussed per building type.

Building 1, the monumental building

The lowest floor in Building 1 consists of a two centimetre thick, well cemented lime layer on top of a layer of platy compact soil (sample 735, Figure 3.3). The latter was only partly present in samples, and was not recognized during fieldwork. The thick lime floor is the thickest and strongest floor discovered at Palloures. Near the centre of the building it borders and merges into a flattened outcrop of limestone bedrock on which the central hearth platform was constructed. Nearer to the walls of the building, the floor was poorly preserved possibly due to ancient and modern disturbances.

Floors from later use phases of Building 1 (from sample 741, see Figure 3.4) consist of massive compact soil and platy compacted soil. This sequence correlates largely with the observation during fieldwork of a first phase in which the building was in pristine condition, with a white plaster inside and out, and later ones which were colloquially known as 'squatter' phases. The floor patches from the latter phase correspond to the compacted soil layers in thin section 741.

As a uniquely thick and well-constructed surface, the first floor of Building 1 can be linked to its monumental size and building quality. Such a thick lime floor may therefore indicate a building of high status. The building was also inhabited after the first lime floor was no longer in use. Two compacted soil floors were constructed later, which appear less well-constructed. These later floors would have lacked the impressive appearance and structural strength of the initial lime floor. This indicates that in later phases, the building was used for a different, less intense and perhaps less representative purpose.

Building 12, the stone building

The succession of a 'primary phase' and subsequent 'unclean' uses of a building in disrepair cannot be applied to the stone building (12) which has the opposite sequence. There, the sequence begins with a massive compacted soil floor, with a deposit of loose brown soil on top. This soil is heterogeneous and contains brown amorphous organic material, micro charcoal, phytoliths and coprolite fragments with bone. This is followed by two separate massive compacted soil layers with several millimetre thick fragmentary, lumpy lime layers on top. If the later applications of lime on the surfaces in this building were related to domestic use, this followed an earlier phase during which the building was deemed suitable for the deposition of waste-ridden soil.

Building 13, the dug-in structure

The sequence observed in Building 13 is 30 centimetres high, but yielded merely two clear floor sequences in thin section. The earliest floor that was observed comprises massive compacted soil with a very thin (<1 mm) lime wash on top. The subsequent twenty centimetres of soil and sand deposits require further investigating for detailed characterization. Above this, a one-centimetre platy compacted soil layer was deposited with a three millimetres thick lime layer directly on top. In the case of this dug-in structure, the presence of familiar floor layers does not appear remarkable in itself. The lack of floor layers in between these is more striking. Perhaps after the first floor was no longer in use, the building was temporarily abandoned and open to the elements. This would suggest a temporary superstructure, dissimilar from the conventional stone and mud walls.

Conventional buildings

There is considerable variety in the floors of the so-termed conventional buildings. Building 7 yielded the same sequence as the first floor of the monumental structure, platy compacted soil overlain with lime. The < 1 cm lime layer from Building 7 is fragmented and considerably thinner than the one from Building 1. It also poorly covers the compacted soil underneath and probably defines a renovation phase. Building 11 yielded a reversed sequence of first, a > 1 cm lime layer and second, a > 1 cm layer of massive compacted soil on top. The transition between the lime and overlying soil is diffuse and, if some mixing of the top of the lime layer can be interpreted as trampling evidence, these comprise separate floor phases. An equally thick lime layer is present in the sample from Building 10, but there it is interjected with a layer of red clay fragments, possibly ochre. Bioturbation in this zone complicates its precise characterization.

The sample from Building 6 was retrieved from an area with patchy preservation, but it nonetheless yielded by far the most abundant floor sequence. Six layers of lime, platy compacted soil, clay and red clay could be observed (Figure 3.2). There is ample evidence for bioturbation which likely caused the lateral disruption of the floor layers as well as their fragmented state. Each layer measures less than seven millimetres and is composed of fine sediments. Fine charcoal and ashes between layers indicate that these likely represent fresh coatings of a surface near a hearth which, although not preserved, was likely nearby. The abundance of layers is therefore expected to indicate an area which required much upkeep.

Discussion

Micromorphological samples from Palloures yielded evidence for a diverse array of floors. Based on the source material used in production, discrete floor types can be identified as clay, compacted soil and lime floor layers. No floor layer contains a combination or mixing of constituents. Clay layers occur only in one sample, which relates to the continued upkeep of the area around a hearth. Apart from one, all samples yielded compacted soil layers. Both platy and massive compacted soil layers can occur as an isolated, single-layer floor. When lime is present, it is usually deposited on top of a compacted soil layer. In three cases lime is the initially deposited layer, these may thus have functioned as a single-layer floor before subsequent layers were deposited.

Floors can further be differentiated by thickness and quality. Compacted soil layers measure between 5 – 20 mm and are on average one centimetre thick. Lime layers vary between single-millimetre deposits and two centimetres thick floors. Lime floors are usually fragmented with poor binding between larger clasts, with the exception of the well cemented compact lime floor of Building 1.

When inhabitants of Palloures constructed a floor, they selected specific materials for this purpose. Their choices could be based on cultural conventions, availability of material and labour, or desired characteristics such as aesthetics or physical strength. The appearance and strength, and the related labour investment for the thick floor of Building 1 indicates that this was constructed to impress or to withstand damaging activities. This corresponds to the size and layout of the building, large enough to accommodate sizeable groups of people. There is therefore a correlation between building function and floor type.

The stone building (12) and dug-in structure (13) represent non-conventional architecture. In both buildings, the initial floor was a single layer of massive compacted soil and later phases included the application of lime. Lime floors in Chalcolithic Cyprus are mostly known from what is considered the 'clean' area in domestic buildings, it is suggested these areas were used for sleeping, eating and receiving guests (Thomas 2005). If lime was therefore considered attractive for clean, domestic activities, Buildings 12 and 13 may have changed toward a domestic function in a later phase of their use life. Importantly, the two non-conventional buildings possess substantial initial floors of compacted soil, followed by brown soil deposits, while most of the conventional buildings have an initial surface constructed with lime. This could indicate that Buildings 12 and 13 were constructed for a different initial purpose than the conventional, perhaps largely domestic, structures. Perhaps the initial function of the non-conventional buildings should be sought in craft related activities.

That all floor layers are composed of either lime, soil or clay, without mixing, could support the earlier floor typology into mainly earth, clay and lime plaster, devised by Thomas (2005). Thin sections have shown that there is considerable variety in the manner of application and thickness of lime layers. The observed sequences also indicate that floor layers rarely occur by themselves, and are seldom followed by a layer of the same material. Floor layers are thus either part of a constructional sequence of base and top layers, or signify the continuous renovation of indoor surfaces. Rather than attributing a single floor type to a use phase of a building, understanding the floor in Chalcolithic Cyprus as a compound structure, is therefore probably nearer to the original constructional notions, as well as to archaeological reality.

Another important characteristic of the investigated floor sequences established by thin section micromorphology, is that all buildings yielded a multitude of floor layers in a seemingly chaotic pattern of superposition, perhaps signifying changes in use of these structures during their use life. It was observed earlier that buildings in Chalcolithic Cyprus varied within settlements, and changed gradually through the Chalcolithic period (Peltenburg 1985; 1991; 1993; Peltenburg *et al.* 1998; Papaconstantinou 2013; Schubert 2018). What this study has shown is that buildings were dynamic structures, which were altered for specific purposes, and with changing outer appearance, during their use life. This increases the resolution for the dynamics of Chalcolithic building and living practices, and adds nuance to the existing narrative.

Conclusion: a functional dialectic

This study revealed substantial variation between buildings in the type and order of floor layers at Chalcolithic *Palloures*. The floor layers themselves are composed of discrete constituents, and a clear difference exists between compacted soil layers, clay layers and floor layers containing lime. For the thick lime floor of Building 1 a correlation between building type and floor function is established. A difference between the initial floor layers of conventional versus non-conventional buildings is also revealed. As such, micromorphological examination of house floors is demonstrated as a promising method to indicate the changing function of buildings when other evidence, such as floor level finds, is lacking.

Future experimental research may explain in more detail what the functional differences between the observed surface types were. Expanding micromorphological sampling in newly excavated areas as well as in old excavations, will help address the dialectic between the standardized composition of discrete layers and their seemingly chaotic organisation in floor sequences. That all buildings yielded such complex sequences of floor layers, suggests that floors in Chalcolithic Cyprus are best understood as a compound structure, reflecting the complex dynamics of both the construction of floors as well as the use life of roundhouses.

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