The micromorphology of period 1 structures

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CHAPTER 25

THE MICROMORPHOLOGY OF PERIOD 1 STRUCTURES

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INTRODUCTION

Micromorphology enables formation of the microstratigraphic units to be classified on the basis of their descriptive sediment attributes and the composition of their geological and anthropogenic inclusions, and assessment of the extent to which the stratigraphy has been altered by post-depositional processes. Micromorphology is well established as a technique for interpreting urban stratigraphy globally (Shahack-Gross *et al.* 2005; Nicosia and Devos 2014; Banerjea *et al.* 2015a; Shillito 2017; Wouters *et al.* 2017). It has previously been applied at Silchester to examine the diachronic use of internal settlement space in later periods of urban occupation (Banerjea 2011a; Banerjea *et al.* 2015a), and refuse disposal practices in the earliest phase of the town (Banerjea 2018). It is applied here to examine the function and evolution of some of the earliest buildings in Insula IX, specifically Buildings 19, 24, 26, 30 and 31 (FIG. 302). This analysis will provide insights into the use of these Period 1 buildings by examining the layout of the buildings, their architectural construction materials, any modifications to these aspects of use of space, the types and spatial arrangements of internal activities and maintenance practices within them. An area of floor 15962 within Structure 31 was sampled as it had a burnt clay surface 15900, and so was considered to have been used as a hearth. The central zone has been heated to extreme temperatures, baking the clay hard, which suggested that this represents the remains of an industrial use hearth. This hearth area within Structure 31 lies below ERTB8, a later, multi-phased building with several hearths, which has produced geochemical enrichments from hearths indicating non-ferrous metal-working (Cook *et al.* 2014), and where micromorphology has shown that this was a poorly maintained structure where hearth debris was allowed to build up, suggesting it served more as a workshop space than a comparably better maintained domestic one (Banerjea 2011a). Micromorphological analysis will examine whether it is possible that the industrial activities within ERTB8, the later structure, represent a continuation of earlier industrial activity within Structure 31.

The results will be compared with those from later buildings within Insula IX (Banerjea 2011a; b; Banerjea *et al.* 2015a) to understand how town life and the structuring of activities changed through time. A description of the geological sediments around Silchester, which are the London Clay, Bagshot Beds, Bracklesham Beds and Silchester gravels, can be found in Banerjea (2011a, 75). Thin-sections from experimentally fired blocks of the Reading Beds geology, produced by John Allen, University of Reading, will be used as comparative data for the investigation of burnt sediments within the roundhouses. Even though the Reading Beds are located to the north of Calleva, the inclusions within the Reading Beds formation come from the same source as the geology surrounding Silchester: the London Clay and the Bagshot Beds. This enables a suitable comparison to be made between the Silchester 'earthen' floor and the experimental data (John Allen, pers. comm.).

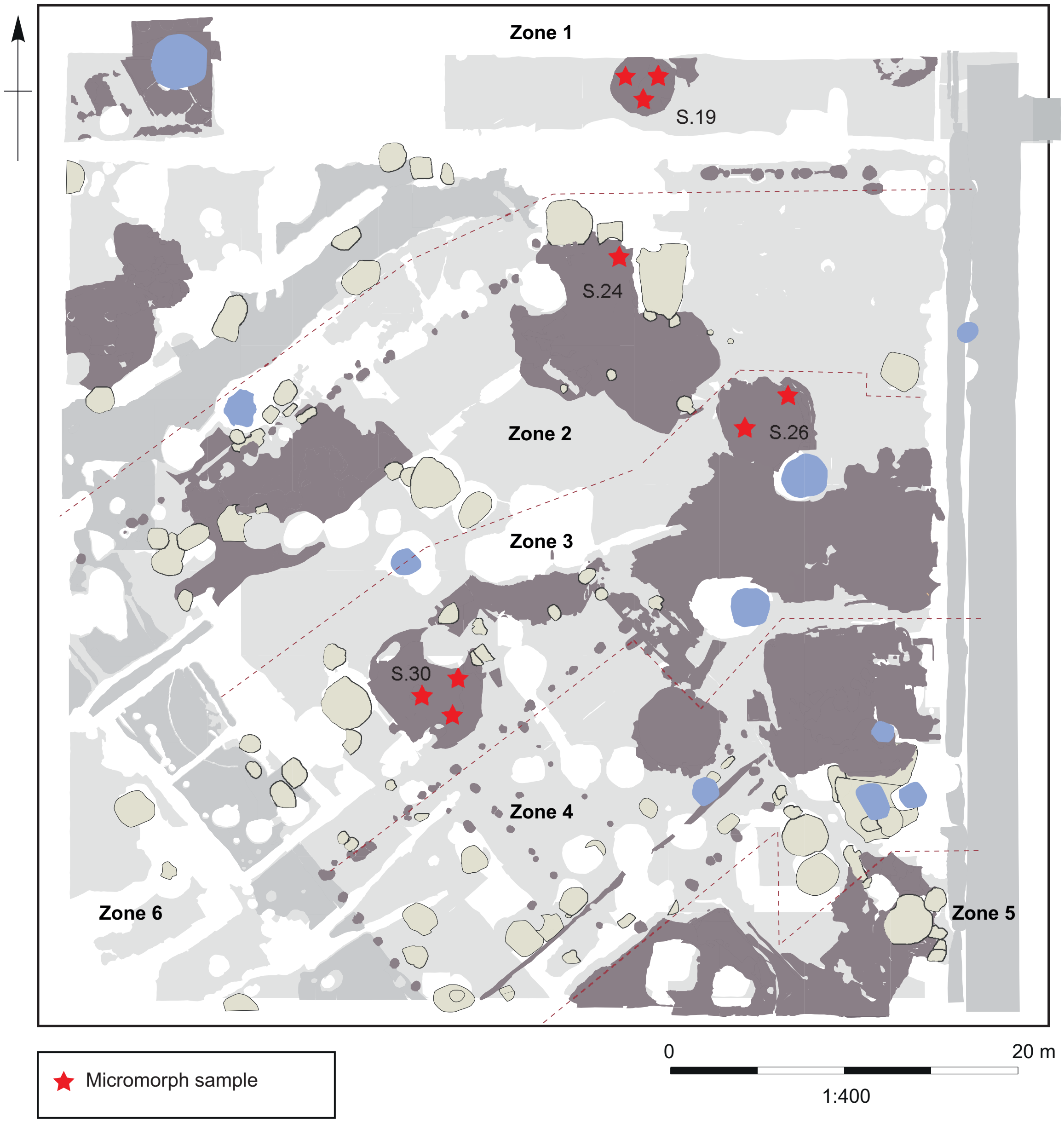

FIG. 302. Distribution plan of the micromorphology samples.

Previously, at Insula IX the changing internal layout and entrances to buildings have been examined spatially by identifying the sediment that was deposited by trampling in doorways (Banerjea *et al.* 2015a). There is a tradition of the use of earth-based materials as flooring during this period, and also the use of pigmented earth-based renders, using glauconite, to create coloured floors (Banerjea 2011b). The changing function of buildings in Insula IX has also been examined using micromorphology. During the mid-Roman period (*c.* A.D. 125–250/300), the supersedence of Early Roman Timber Building 1 (ERTB1) by Mid-Roman Timber Building 1 (MRTB1) shows a single-roomed domestic structure was extended with the addition of a well-maintained annex with a mortar floor. The mortar floor was later replaced by an earthen floor and then the two rooms were joined to create a partially-roofed area and the floor covered by a levelling deposit comprising recycled floor material and refuse. The space was then used to stable ruminant livestock (Banerjea 2011b).

SAMPLING METHODS

Three samples were collected from Structure 19: 10848, 10871, 10963. Sample 10963 was collected from a central area within the roundhouse that was considered to be a hearth. Samples 10848 and 10871 were collected from context 16025 and context 13571 is the upper microstratigraphic unit in sample 10871. During excavation, both contexts were considered to relate to the abandonment or partial abandonment of the building. Three samples were collected from Structure 26. Sample 7742.1 was collected from a hearth area and is of a scorched earthen floor, context 13086. The hearth was covered by levelling deposits 13031 (sample 7406) and 13064 (sample 7409), which both represent the same horizon of floor preparation. Three samples were collected from a rubified surface, context 7975, within Structure 30: 3381, 3382 and 3383. Sample 3381 was collected adjacent to the hearth, while 3382 and 3383 were further away, almost equidistant. Sample from Structures 19, 26 and 30 were collected by creating 'working sections' or small slots through the floor deposits to spatially sample buildings. Sample 5297 was collected from Structure 24 from section 98 from occupation deposits that had slumped into Pit 11694. One micromorphology sample was collected from deposit 15900 that was considered, during excavation, to be part of a clay floor, 15962, in Structure 31. The x, y, z coordinates were recorded for each sample.

LABORATORY METHODS

The procedure followed is the University of Reading standard protocol for thin section preparation. The samples were oven-dried to remove all moisture and then impregnated with epoxy resin while under vacuum. The impregnated samples were then cut, mounted onto glass slides and lapped to the standard geological thickness of 30 μm.

Micromorphological investigation was carried out using a Leica DMLP polarising microscope at magnifications of x40–x400 under Plane Polarised Light (PPL), Crossed Polarised Light (XPL) and, where appropriate, Oblique Incident Light (OIL). Thin-section description was conducted using the identification and quantification criteria set out by Bullock *et al.* (1985) and Stoops (2003), with reference to Courty *et al.* (1989) for the related distribution and microstructure, Mackenzie and Adams (1994) and Mackenzie and Guilford (1980) for rock and mineral identification, and Fitzpatrick (1993) for further identification of features such as clay coatings. Tables of results use the descriptions, inclusions and interpretations format used by Matthews (2000) and Simpson (1998). Photomicrographs were taken using a Leica camera attached to the Leica DMLP microscope.

Micromorphology enables the following properties to be examined at magnifications of x40–x400 under PPL, XPL and OIL: thickness, bedding, particle size, sorting, coarse:fine ratio, composition of the fine material, groundmass, colour, related distribution, microstructure, orientation and distribution of inclusions, the shape of inclusions, and, finally, it enables the inclusions to be identified and quantified. In addition, the chemical and physical post-depositional alterations can be identified and quantified.

CLASSIFICATION OF DEPOSIT TYPES

The microstratigraphic units from within Structures 19, 24, 26, 30 and 31, ~~and the deposits under the East–West street~~ have been classified into six main deposit-type classifications with sub-groups (Table 66). The full descriptions for the microstratigraphic units are presented in tables in online Appendix 19). The sediment attributes were interpreted for the microstratigraphic units and to group them according to their formation processes. These were classified further according to their types of inclusions and any small differences in the sediment attributes. The main deposit types are: accumulations, discard deposits, earthen floors, levelling deposits, rake-out deposits and mixed deposits.

TABLE 66. THE CLASSIFICATION OF MICROSTRATIGRAPHIC DEPOSIT TYPES FOR THE PERIOD I BUILDINGS

Deposit type	Deposit sub-type	Unit	Sample	Structure	Post-dep trampling
Accumulation	Accumulation	16025	10848	19	YES
		MU3	10871	19	YES
		MU10	5297	24	
		MU15	5297	24	YES
		MU1	7406	26	YES
		MU6	3381	30	
	Accumulation: use of mats	MU2	10848	19	
		MU1	10871	19	YES
		MU2	10871	19	YES
		MU9	5297	24	
		MU12	5297	24	YES
		MU2	7406	26	
	Accumulation: reworked	MU11	5297	24	
	Accumulation: scorched	MU2	3381	30	YES
Discard	Discard	13571	10871	19	YES
		MU4	10871	19	
		12928	7409	26	
Earthen floor	Earthen floor	MU3	10848	19	
		MU2	5297	24	
		MU7	5297	24	
		MU17	5297	24	
		MU3	7406	26	
	Earthen floor repair	MU4	5297	24	
	Earthen floor render	MU16	5297	24	
	Earthen floor sub-floor	MU8	5297	24	
	Earthen floor: scorched	16046	10871	19	
		MU6	5297	19	
		MU14	5297	19	
		13086	7742.1	26	
		MU2	10978	31	
	Earthen floor: vitrified	MU13	5297	24	
		MU1	3381	30	
		MU1	10978	31	

Levelling	Levelling	16114	10963	19	
		MU1	10848	19	
		16053	10848	19	
		MU3	5297	24	
		MU18	5297	24	
		13031	7406	26	
		13064	7409	26	
	Levelling: redeposited	MU1	5297	19	
Rake-out	Rake-out	16112	10963	19	
		MU1	7409	26	
		MU2	3382	30	YES
		MU3	3382	30	
		MU2	3383	30	YES
	Rake-out: hearth base	16113	10963	19	
		MU5	3381	30	
		MU7	3381	30	
		MU1	3382	30	YES
		MU1	3383	30	YES
		MU2	3383	30	YES
Mixed deposits	Accumulation/ rake-out scorched	MU3	3381	30	
		MU4	3381	30	
	Earthen floor/ rake-out (hearth base) scorched	MU5	10871	19	
		MU6	10871	19	
	Earthen floor/ accumulation vitrified	MU5	5297	24	
	Levelling/ rake-out	MU2	7409	26	
		MU3	3383	30	

ACCUMULATION DEPOSITS

Accumulation deposits are found in all buildings and represent the *in-situ* formation of residues, i.e. primary deposits (Schiffer 1987), of either dust or refuse that still remain in their initial place of deposition. They are split further into three sub-groups: accumulations from the use of mats, accumulation deposits that are reworked, and accumulation deposits that are scorched. The latter two sub-types have been affected by post-depositional processes, i.e. have been substantially reworked or substantially burnt after deposition.

All the sub-groups of accumulation deposits mostly have a microlaminated bedding structure, which shows period deposition of sediment (Banerjea *et al.* 2015b; Goldberg and Macphail 2006, 221). They are divided into sub-groups according to variations in sorting and particle size. Most accumulation deposits, including those that have been reworked or scorched, have a dominant sand component to their particle size (sandy clay loam, sandy silt loam, sandy loam, loamy sand) and are poorly sorted or unsorted (if altered by post-depositional processes); whereas those that have formed arising from the use of mats have a finer grained and/or more dominant silt component (such as clay loam, silty clay, silty clay loam) and have bimodal sorting with a moderately to well sorted silt component (Matthews 1995).

Microstratigraphic units MU2, sample 10848, MU1 and MU2, both sample 10871, MU9 and MU12, both sample 5297, and MU2, sample 7406 (Table 66), are classified as accumulation

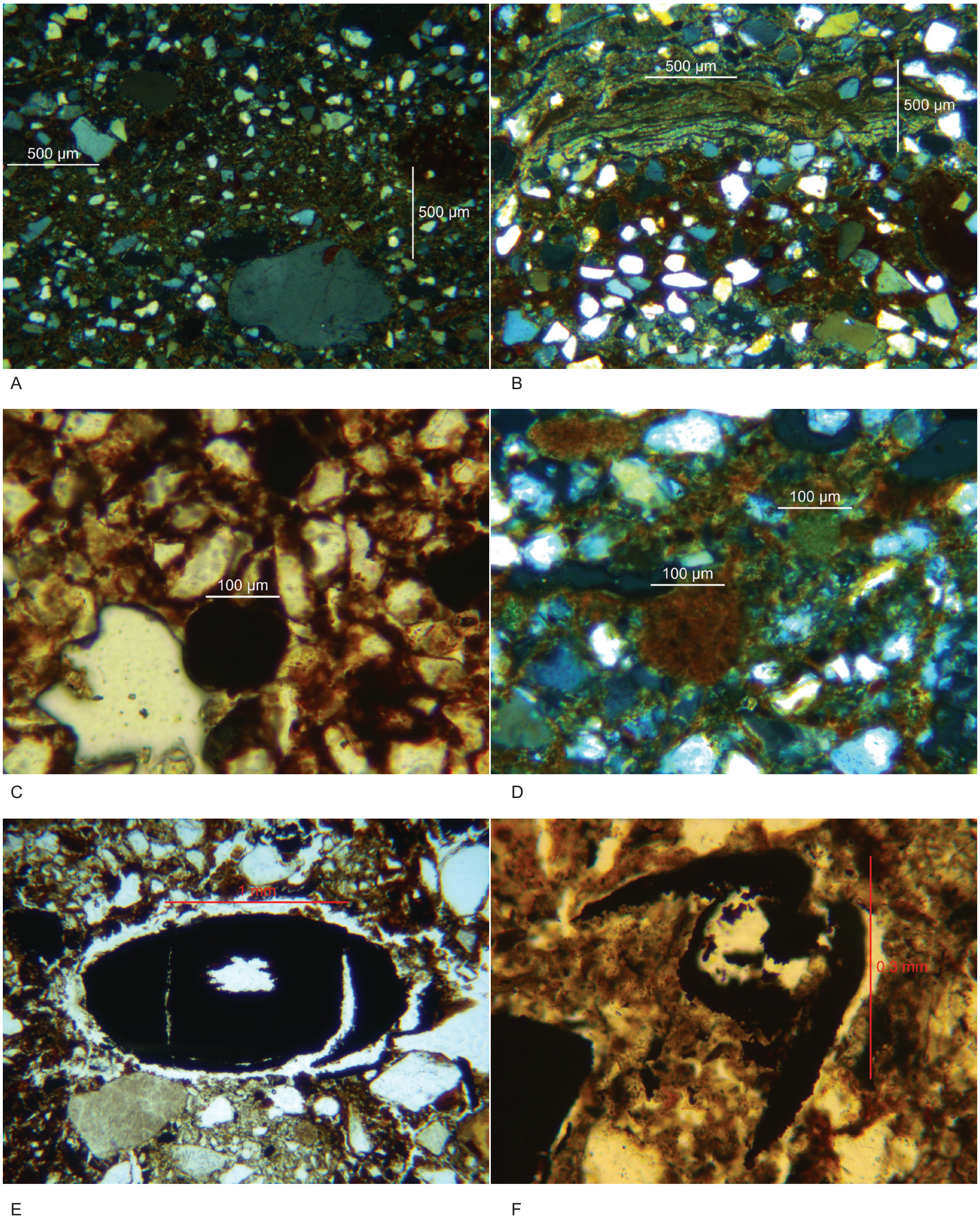

FIG. 303. Photomicrographs. A. Lens of well-sorted silt that may have accumulated as a result of the use of a mat, MU9, sample 5297; B. Floor render pigmented with muscovite mica minerals, MU16, sample 5297; C. Blackened glauconite mineral indicating firing temperature c. 800°C, MU5, sample 5297; D. Orange glauconite mineral indicating firing temperature of c. 400–600°C (left); unburnt glauconite mineral (right), MU6, sample 5297; E. Charred seed, context 16112, sample 10963; F. Charred chaff, context 16112, sample 10963.

deposits arising from the use of mats and occur in Structures 19, 24 and 26. These deposits form where a textile or reed mat effectively acts as a sieve that sorts out specific particle sizes when sediment has percolated through the apertures in the mat (FIG. 303A). This sediment formation process has been suggested for the formation of fine, thin lenses, 200–700μm in thickness, in compacted, irregular deposits within domestic spaces at Abu Salabikh, Iraq (Matthews 1995, 60), and could be observed experimentally within the Moel-y-Gerddi roundhouse, St Fagans, National History Museum, Wales (Banerjea 2015a).

The accumulation deposits and sub-groups either contain no activity residues, or extremely low abundances of burnt glauconite minerals, 5–20 per cent, charred wood and other organic remains, 5–20 per cent (Table 130).

DISCARD DEPOSITS

Discard deposits are secondary depositions of refuse, i.e. residues that have been removed from their primary place of deposition by maintenance and redeposited (Schiffer 1987; LaMotta and Schiffer 1999). Their diagnostic sediment attributes are coarse particle sizes (sand or loamy sand), they are unsorted, have a linked and coated related distribution, whereby the coarse components are linked by bridges of finer material, and inclusions are unoriented, unrelated, randomly distributed and unreferred. These processes can be associated with haphazard deposition and are observed elsewhere at Silchester (Banerjea 2011a; b), in occupation deposits from experimental sites (Banerjea *et al.* 2015b), and on sites in the Near East (Matthews 1995). The discard deposits contain more anthropogenic refuse than accumulation deposits (Table 130), and mainly comprise residues relating to burning, very low abundances of burnt and non-burnt bone (<5 per cent), and aggregates of earthen building materials that probably entered the floor residues due to abrasion and erosion.

These deposits have been identified in Structures 19 and 26. The occurrence of discard deposits within buildings can often represent a period of abandonment or partial abandonment (LaMotta and Schiffer 1999). Discard deposit 13571 in Structure 19 was identified during excavation as overlying surfaces and post-holes and possibly relating to abandonment prior to the construction of the East–West street. Context 16025, also in Structure 19, was identified during excavation as relating to a period of abandonment. Micromorphological analysis shows that 16025 actually comprises several microstratigraphic units of which microstratigraphic MU4, sample 10871, is a discard deposit. Discard deposit 12928 in Structure 26 was also identified during excavation as probably relating to the disuse of the roundhouse.

EARTHEN FLOORS

This classification relates to constructing earthen floors using earth in a similar way to creating bricks and walls, either in its unaltered form, such as brickearth (Goldberg and Macphail 2006) or with additional sand as a stabiliser, and/or plant remains to prevent cracking (Friesem *et al.* 2017). This method of floor construction is frequently used in earth building (Houben and Guillaud 1994; Norton 1997; Keefe 2005), and has been observed experimentally (Banerjea *et al.* 2015b) ~~at~~ Silchester (Banerjea 2011a; b) and in the Near East (Matthews *et al.* 1997).

The earthen floor deposits are split further into six sub-groups (Table 66): earthen floors, earthen floor repair, earthen floor render, earthen sub-floor, earthen floor scorched, and earthen floor vitrified. Similar to the sub-groups of accumulation deposits, the latter two sub-types have been affected by post-depositional processes, i.e. been substantially burnt after deposition, but to different temperatures making them scorched (or rubified) or vitrified. In comparison with thin-sections of experimentally fired clays from Silchester by John Allen, University of Reading, the vitrified fabric of MU5, sample 5297 (Structure 24), and MU1, sample 10978 (Structure 31), are optically comparable with sediment fired >1200°C, and MU13, sample 5297 and 13086 (Structure 24), and MU2, sample 10978 (Structure 31), with sediment fired <1000°C. Those floors that are scorched (or rubified) are optically comparable with sediment fired between 300 and 1000°C. An earthen sub-floor is an earth-based levelling material onto which the floor is laid (Norton 1997).

The earthen floor deposits, with the exception of the earthen floor render, all have similar coarse particle sizes: sandy loam, loamy sand and sandy clay loam. They are generally unsorted, but earthen floors MU3, sample 10848 (Structure 19), and MU13 and MU14, both sample 5297 (Structure 24), are moderately sorted, and MU4 and MU7, both sample 5297 (Structure 24), are poorly sorted. All have an embedded and coated related distribution, whereby the coarser mineral components are embedded within the finer clay matrix. The floors contain very rare, probably accidental or reworked anthropogenic inclusions of fragments of earthen building material, pottery fragments, charred wood and charred plant remains, 10–20 per cent (Table 130). These properties are consistent with earthen floors within buildings from Periods 2 and 3 at Silchester (Banerjea 2011a; b). The mineral assemblages of the Period 1 floors, which comprise mainly quartz, 40–50 per cent, with some low abundances of plagioclase (feldspar), muscovite (mica) and glauconite are also similar to those of Periods 2 and 3 (Banerjea 2011a; b), which could again represent a local source from the London Clay, Bagshot Beds and Bracklesham Beds geology (Banerjea 2011~~a~~, 75).

The earthen floor render is different from the earthen floors. It is a very thin lens, 0.1–0.2 mm in thickness, has a silty clay particle size, comprises mostly muscovite minerals, 70 per cent (Table 130), and is microlaminated as if applied to the surface in layers like paint (FIG. 303B).

Earthen floors (and sub-groups) occur in all buildings, but mainly in Structures 19, 24 and 26, with four of the six earthen floor deposits in sample 5297 located and superimposed on one another within Structure 24 (Table 66). The earthen floor repair, render and sub-floor sub-groups only occur in Structure 24. Burnt floors, scorched or vitrified, occur in all buildings, but only a vitrified floor was identified in Structure 30, MU1, sample 3381.

LEVELLING DEPOSITS

Levelling deposits are depositions of sediment that are used to create a level surface prior to the construction of a new building or modification of an existing building. They have a coarse particle size, sand or loamy sand, with gravel-sized inclusions and are unsorted; they are consistent with those in Periods 2 and 3 at Silchester (Banerjea 2011 a; b). The gravel-sized inclusions comprise flint rock fragments, which range from 20 to 50 per cent in abundance (Table 130). The other main types of inclusions are mostly geological and predominantly comprise quartz, 30–50 per cent. Some anthropogenic materials, <25 per cent, such as bone, charred wood, fragments of coprolite or dung (Table 130) occur within the levelling deposits, which could have been incorporated in the sediment at the time of deposition or, as in the case of the aggregates of earthen floor in MU3, sample 5297 (Structure 24), been reworked from microstratigraphic units above and below by post-depositional trampling or mesofaunal agents. MU1, sample 5297, is actually sediment from MU3 that has been redeposited by mesofaunal action that truncated MU2.

Levelling deposits occur in Structures 19, 24 and 26. The levelling deposits in Structure 19 contain the greatest abundances of anthropogenic debris: non-burnt bone, coprolite fragments, charred wood, amorphous charred plant remains and phytoliths (Table 130).

RAKE-OUT DEPOSITS

This classification refers to deposits associated with the maintenance of fire installations. Rake-out deposits classify material that lies in close proximity to hearths (Mallol *et al.* 2017), containing melted quartz, rubified sediment aggregates, vesicular sediment, charred organic remains, ash, fuel-ash slag, phytoliths and melted silica (Table 130), which have been moved from the primary place of deposition within the hearth itself (Banerjea *et al.* 2015b). Rake-out deposits are unsorted, and inclusions are unoriented, unrelated, randomly distributed and unreferred, which can indicate haphazard depositional processes resulting from discard and maintenance practices (Matthews 1995; Banerjea *et al.* 2015b).

A distinction has been made between rake-out deposits that mainly comprise fuel residues, and those that contain mainly mineral and constructional material from the base of the hearth.

Those rake-out deposits from the base of the hearth (Table 66) contain higher frequencies of mineral inclusions, particularly burnt glauconite (Haaland *et al.* 2017), and rubified sediment aggregates that possibly derive from burnt sediment within the hearth from its firing platform (Banerjea 2015b).

Rake-out deposits occur in Structures 19, 26 and 30 and rake-out deposits from the base of the hearth occur only in Structure 30 and in all three samples: 3381, 3382, 3383. Sample 3381 was collected adjacent to the hearth and 3382 and 3383 are further away, almost equidistant.

MIXED DEPOSITS

The occurrence of deposits that have formed as a result of more than one depositional formation process is not an uncommon observation for occupation deposits as it is arguable that in some deposits there will be a mixture of anthropogenic and wind/water laid materials (Macphail 1994; Matthews *et al.* 1997; Goldberg and Macphail 2006). Combustion residues can be reworked, redistributed or reused in a variety of other deposit types, including dumps, construction materials and as fertilisers (Mallol *et al.* 2017). Seven microstratigraphic units are classified as mixed deposits, and Structures 19, 24, 26 and 30 all contain mixed deposits (Table 66). MU5 and MU6, both sample 10871 (Structure 19), are mixed earthen floor and rake-out (base of the hearth) deposits that have been scorched post-deposition. MU2, sample 5297 (Structure 24), is a mixed earthen floor and accumulation deposit that has been vitrified post-deposition. MU2, sample 7409 (Structure 26), and MU3, sample 3383 (Structure 30), are mixed levelling material and rake-out deposits. Also in Structure 30, MU3 and MU4, both sample 3381, are mixed accumulation and rake-out deposits.

ACTIVITY RESIDUES

The main types of activity residues that were identified in Structures 19, 24, 26 and 30 relate to very high temperature burning, hearth activity (fuel use) and general domestic activity.

High temperature burning

Several combustion features were identified that relate to burning at high temperatures, which are glauconite minerals burnt up to 800°C (Haaland *et al.* 2017); melted quartz (Courty *et al.* 1989; Goldberg and Macphail 2006, 284); and vesicular sediment (Goldberg and Macphail 2006; Mallol *et al.* 2017). Examination of burnt glauconite minerals in relation to the deposit type classification provides information about the potential origin of the burning, i.e. were the minerals burnt *in situ* or are they redeposited?

The floors of Structure 24 show evidence that they were fired *in situ*. MU5, sample 5297, is a mixed deposit type that has formed both by accumulation processes and post-depositional vitrification of the floor surface: the residues on the floor surface were fused onto the floor itself as a result of high burning temperatures. MU5 contains blackened glauconite minerals (FIG. 303C), 10 per cent, suggesting that they have been burnt *in situ* at temperatures of *c.* 800°C (Haaland *et al.* 2017). The colour of the glauconite minerals shows a reduction in temperature in the microstratigraphic units directly below: in MU6 they are orange to dark orange (FIG. 303D) indicating temperatures of *c.* 400–600°C (Haaland *et al.* 2017), and orange in MU7 and MU8, indicating temperatures of *c.* 400°C (Haaland *et al.* 2017). In comparison with thin-sections of experimentally fired clays from Silchester by John Allen, University of Reading, the sediment of MU5 is consistent with the fabric of sediment fired at temperatures >1200°C. The rubification and discolouration of the sediments show a vertical drop-off pattern of temperature, as does the discolouration of glauconite minerals. The depth and extent to which fire effects the sediments directly below can depend on a variety of factors such as temperature, clay mineralogy of the sediment and the presence of a firing platform (Mallol *et al.* 2017). Earthen floors MU13 and MU14 further down the profile in sample 5297 (Structure 24), contain glauconite minerals burnt at 600–800°C and the rubification and discolouration of the sediments also shows a vertical drop-off pattern of temperature. Context 13086, sample 7742.1 (Structure 26), also shows a vertical drop-off pattern of temperature with the fabric of the sediment optically comparable with fired-at temperatures <1000°C and glauconite minerals that are orange to dark orange indicating temperatures of *c.* 400–600°C (Haaland *et al.* 2017).

In Structure 30, the vitrified floor surface, MU1, and scorched accumulation deposit, MU2, which are *in-situ* deposits from sample 3381 that was collected adjacent to the hearth, contain glauconite minerals burnt between 600 and 800°C. Secondary deposits such as rake-out materials from Structure 30, contain glauconite that has been burnt at a range of temperatures between 200 and 800°C, which is consistent with the deposition of reworked materials from around the hearth area, but also contain other combustion features indicating lower temperatures such as charred wood, fuel-ash slag, ash and melted silica (Mallol *et al.* 2017). This could indicate the hearth was multi-purpose.

In Structure 31, micromorphological analysis has separated field context 15900 into two microstratigraphic units (MU1 and MU2, sample 10978) primarily on the basis of colour distinction related to burning (Table 129): MU1 is the vitrified or scorched surface of the floor. The temperature effects based on thin-section analysis show the temperature changes on the sediment lower in MU2.

Fuel types

The main type of fuel that is represented is wood; charred wood dominates assemblages of combusted materials (Table 130). Wood ashes were not identified in Structures 19, 24, 26 and 30, with the exception of a very low abundance, <5 per cent, of decalcified ash in Structure 30. This could suggest that any calcitic ashes have dissolved as a result of acidic preservation conditions. The fragments of charred wood are unidentifiable, poorly preserved and fragmented, which could be a result of trampling processes that are evident in all the buildings (Table 66).

Other potential types of fuel include burnt dung, 10 per cent, MU3, sample 3382, Structure 30, and potentially crop-processing waste in Structure 19, which comprises charred seeds (FIG. 303E; Ismail-Meyer 2017), burnt chaff (FIG. 303F; Nicosia and Canti 2017), amorphous charred plant remains, phytoliths and melted silica.

Domestic refuse

Structures 19, 24, 26 and 30 contain very low abundances of domestic refuse such as pottery fragments, bone, egg shell and shells from oysters and mussels, which are recorded in much higher abundances in other buildings at Silchester (Banerjea 2011a, b). Building 19 contains the only fragment of pottery, <5 per cent, but this is within the fabric of an earthen floor, MU3, sample 10848, and therefore probably included when the floor was prepared. Low abundances of bone fragments (Table 130), both moderately burnt up to 400°C (Villigran *et al.* 2017) and non-burnt, occur in secondary deposits, mostly discard and rake-out deposits, within Building 19. Rake-out deposits in sample 3382, Building 30, also contain low abundances of mainly non-burnt bone.

SUMMARY OF PRIMARY RESIDUES

Accumulation deposits, which are primary deposits, do not contain high abundances of activity residues, suggesting that the buildings were well maintained, and that the predominantly mineral material probably derives from wind-blown dust, or sediment from the abrasion of earthen building materials. Accumulation deposits that formed from the use of mats, that are reworked or scorched contain even fewer activity residues than accumulation deposits.

Accumulation deposits within Structures 24 and 30 contain very low abundances of activity residues: burnt sediment aggregates, <10 per cent, charred wood, <10 per cent (Structure 24); and burnt glauconite, 20 per cent (Structure 30). In Structure 30, sample 3381 was collected adjacent to the hearth, whereas 3382 and 3383 were collected further away, which could explain why more primary accumulation deposits occur in sample 3381 and more secondary rake-out deposits occur in samples 3382 and 3383.

Accumulation deposits from Structures 19 and 26 contain greater abundances of activity residues and a wider range of types of inclusion, but still mainly relating to hearth activity and some high temperature burning: both contain burnt glauconite, <5 per cent; charred wood, 20 per cent in Structure 19, and <5 per cent in Structure 26; amorphous charred organics, <5 per cent in both buildings; burnt sediment aggregates, <5 per cent, Structure 26; dung, <5 per cent, Structure 26; phytoliths, <5 per cent, Structure 19.

SUMMARY OF SECONDARY RESIDUES

Rake-out deposits, although often located near to the hearth, are technically secondary deposits as the sediment is no longer in the original place of deposition. Rake-out deposits formed in Structures 19, 26 and 30 predominantly contain burnt glauconite minerals, charred wood and burnt sediment aggregates. However, there are more building and/or sample specific collections of activity residues within rake-out deposits: moderately burnt bone, 5 per cent, occurs in sample 10963, Structure 19, and burnt and non-burnt bone, <10 per cent, occurs in sample 3382, Structure 30; burnt dung, 10 per cent, occurs in sample 3382, Structure 30; charred seeds and charred chaff occur in sample 10963, Structure 19, which, given the additional presence of phytoliths and melted silica, could indicate the burning of crop-processing residues on the hearth in this building.

Discard deposits are secondary depositions of refuse and their occurrence within buildings can often represent a period of abandonment or partial abandonment (LaMotta and Schiffer 1999), which is apparent in Structures 19 and 26. The activity residues within sample 10871, Structure 19, represent those that occur in primary accumulation deposits and rake-out deposits ~~and~~ probably result from general building maintenance from areas where meat had been prepared for cooking, resulting in residues of moderately burnt bone and non-burnt bone, and the burning of crop-processing residues on the hearth, resulting in residues of amorphous charred plant remains, phytoliths and melted silica. The discard deposit, 12928, sample 7409, Structure 26, mostly contains aggregates of eroded earthen building material and fragments of charred wood.

ZONE 1

STRUCTURE 19

Three samples were collected within Structure 19: 10848, 10871 and 10963 (FIG. 304). Sample 10963 was collected from a central area within the roundhouse that was considered to be a hearth. The upper two microstratigraphic units of sample 10963, 16112 and 16113, are rake-out deposits relating to the maintenance of the hearth area. These rake-out deposits contain residues that could indicate the disposal of crop-processing waste on the hearth and its use as fuel.

Samples 10848 and 10871 were collected from context 16025; context 13571 is the upper microstratigraphic unit in sample 10871. During excavation, both contexts were considered to relate to the abandonment or partial abandonment of the building. In particular, context 13571 was identified during excavation as overlying surfaces and post-holes, possibly prior to the construction of the East–West street and of Period 2 date. Micromorphological analysis shows that 16025 actually comprises several microstratigraphic units of which MU4, sample 10871, is a discard deposit.

On the basis of the presence of internal discard deposits, sample 10871 shows that there are two potential periods of partial abandonment in Building 19. These periods of abandonment are preceded by scorched earthen floor and rake-out deposits (MU5, MU6, 16046), interspersed with accumulated sediment (MU3), some of which formed from the use of mats (MU1 and MU2). There are three levelling deposits: one at the base of sample 10963 (16114); and two in sample 10848, which includes one at the base (16053), and one below the upper stratigraphic unit (MU1). Levelling deposits 16053 and MU1, sample 10848, are separated by an earthen floor (MU3) and an accumulation of sediment that formed from the use of mats (MU2).

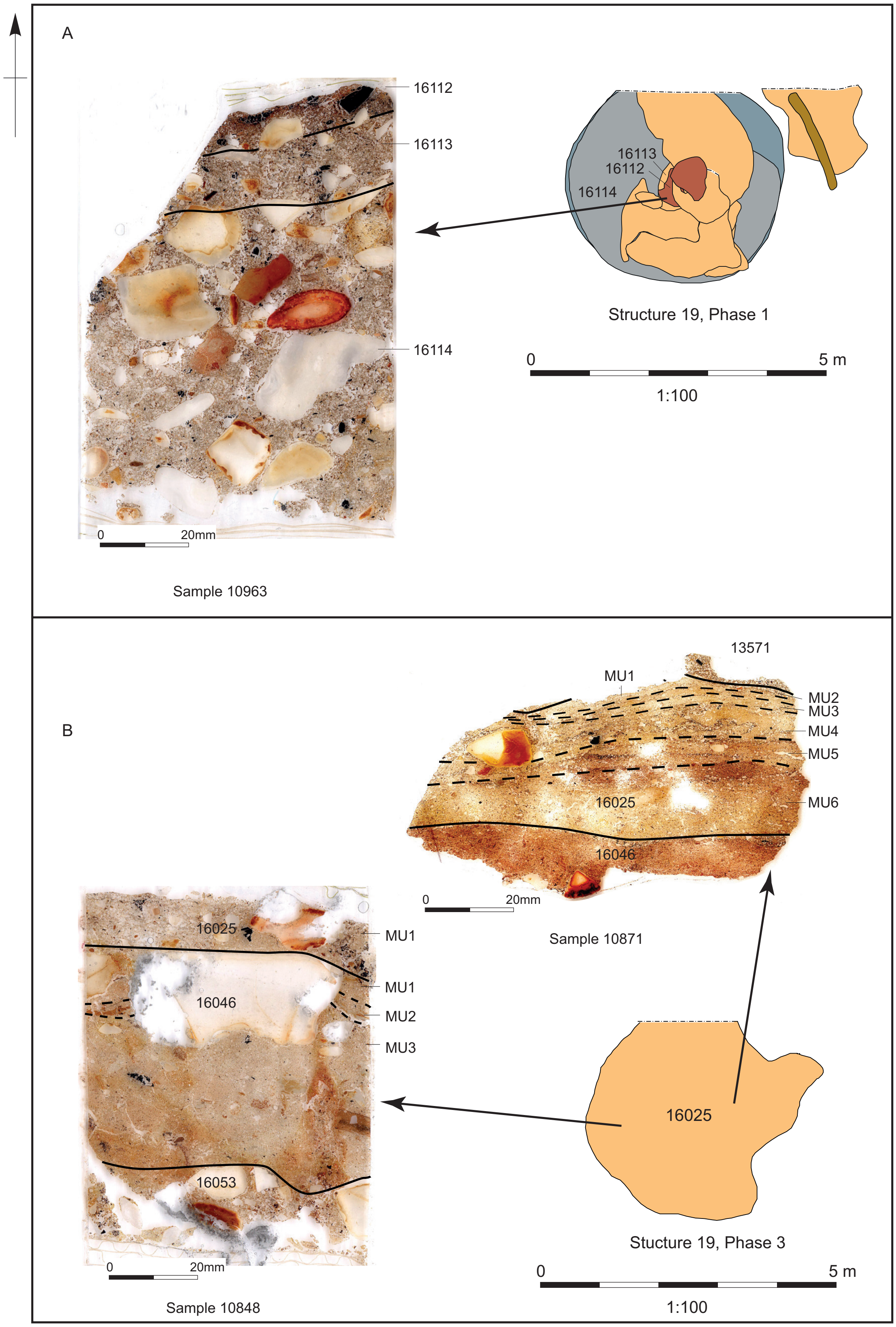

FIG. 304. The location of micromorphology samples through contexts in Structure 19 and their associated slides.

Both samples 10848 and 10871 show that context 16025 comprises several microstratigraphic units. The microstratigraphic units in each sample have been tentatively correlated. Contexts 16053 and 16046 could be part of the same earthen floor surface, albeit different patches of repairs. There was then a period of poorer maintenance where rake-out and discard deposits formed. Then mats were put down in the building, correlating microstratigraphic units MU1 and MU2, sample 10871, and MU2, sample 10848. Levelling deposit MU1, sample 10848, is overlaid with an accumulation deposit with charred inclusions relating to the fuel on the hearth (16025, sample 10848) and could relate to a modification of the building's form.

Bulk geochemistry was conducted spatially across context 16025 (Cook, p. 000), which micromorphology has shown to comprise several microstratigraphic units; low elemental concentrations are consistent with the low levels of activity residues in this building. The elemental concentrations are highest in the area around the hearth and are probably caused by organic materials used as fuel on the hearth.

ZONE 2

STRUCTURE 24

Sample 5297 was collected from section 98 from occupation deposits that had slumped into Pit 11694 (FIG. 305). This sample produced a dynamic sequence of superimposed floor surfaces with three horizons of levelling (MU3, MU8 , MU18) that are followed by episodes of reflooring (MU2, MU5, MU6, MU7, MU13, MU14, MU16, MU17), floor repair (MU4) and accumulation deposits (MU9, MU10, MU11, MU12, MU15). There are two periods of burning that have severely burnt the earthen floor surfaces leaving them scorched or vitrified: (1) MU13 and MU14; and (2) MU5 and MU6. These high-temperature burning events are not associated with industrial residues and discard deposits. Geochemical data from the fills of pits in Zone 2 (Cook, p. 000) do not indicate that refuse from industrial activities such as metal-working was discarded into them. Residues of plant materials, which could be matting or dung, are fused onto the surface of MU6 forming a mixed accumulation and floor surface, MU5, which suggests that the burning events in Structure 24 could be the result of either deliberate or accidental fire. The destruction of the building by fire could be a method of clearing the area for a new phase of construction.

Structure 24 was a well-maintained building. The accumulation deposits contain very low abundances of activity residues and mainly comprise mineral material, which probably derives from wind-blown dust, or sediment from the abrasion of earthen building materials such as earthen floors by trampling and sweeping. Trampling processes are evident in Structure 24 by the occurrence of sub-horizontal cracks (Table 131) in MU12 and MU15 and are comparable to the Gé *et al.* (1993) 'reactive zone' that displays cracks at the interface between the floor surface and the overlying deposits. During the period between the burning event that vitrified earthen floor MU13 and the laying of earthen sub-floor MU8, there are two accumulation deposits that indicate the use of mats within the building, MU9 and MU12. Despite the modifications to the floors of Structure 24, there is no evidence from the primary accumulation deposits in sample 5297 that this building changed in function during its life-history, nor that this building was used for anything other than domestic habitation. The earliest earthen floor, MU17, is rendered with a fine mica-based paint. This is not the first time a single mineral has dominated an earth-based render at Silchester, in ERTB5, Period 2, glauconite was used as a pigment to give a floor render a greenish blue colour (Banerjea 2011a). Structure 24, like ERTB5, suggests that these floor renders are high quality finishes for houses rather than industrial spaces.

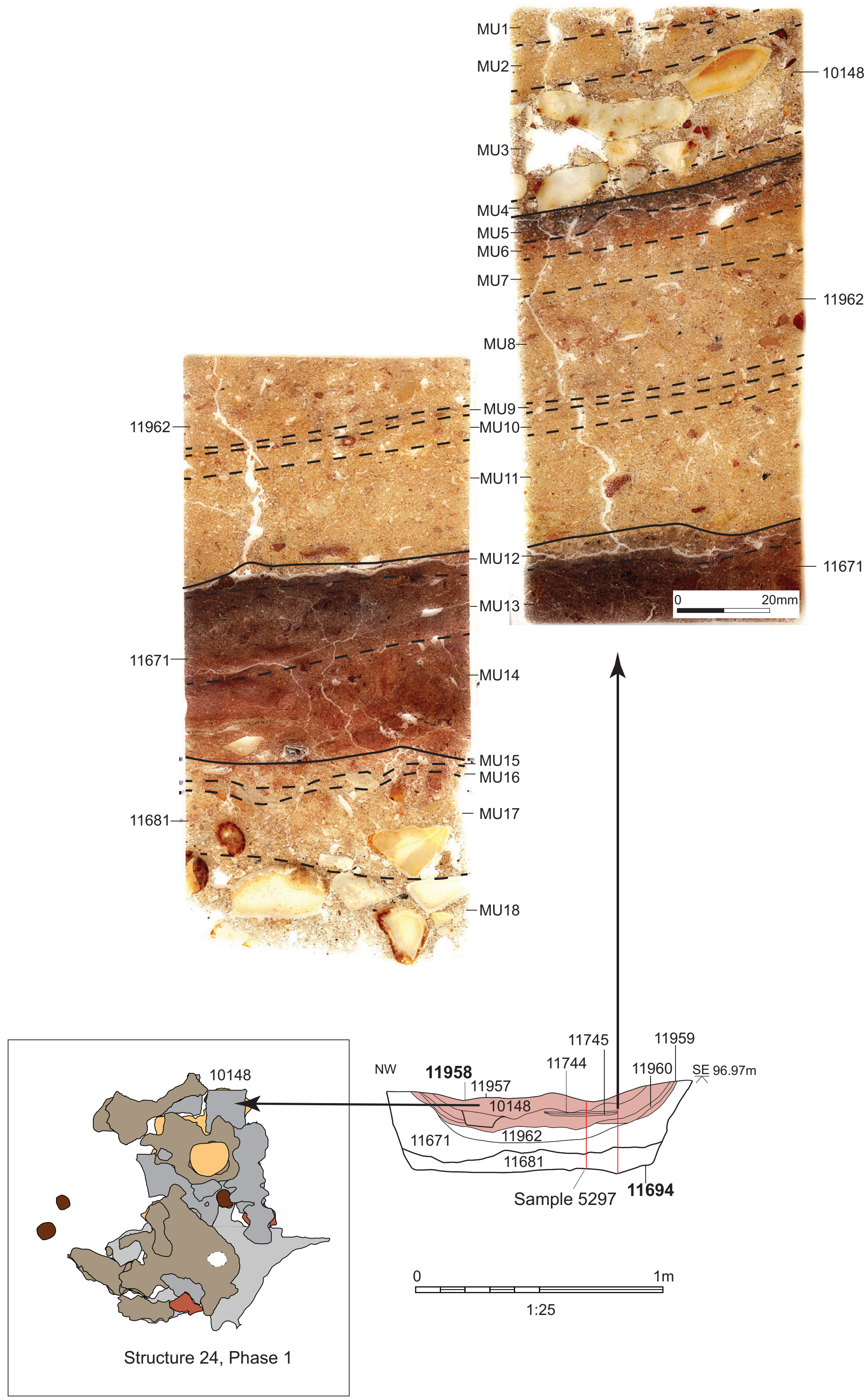

FIG. 305. The location of the micromorphology sample through contexts in Structure 24 and its associated slide.

ZONE 3

STRUCTURE 26

Samples 7406, 7409 and 7742.1 represent a cycle of use through to abandonment or partial abandonment in Structure 26 (FIG. 306). Sample 7742.1 was collected from a hearth area and is of a scorched earthen floor (13086). The heat alteration of the sediment, the rubification and discolouration of the sediments show a vertical drop-off pattern of temperature similar to those in Structure 24 (MU5, MU6, MU7, MU8, MU13 and MU14, all sample 5297), and indicate firing temperatures of <1000°C.

The hearth was covered by levelling deposits 13031, sample 7406, and 13064, sample 7409, which both represent the same horizon of floor preparation. In sample 7406, the levelling deposit is overlaid by an earthen floor, MU3, and in sample 7409, the levelling deposit is overlaid by a mixed levelling and rake-out deposit, MU2, and then a rake-out deposit, MU1, from the use of the new hearth within the building. The earthen floor, MU3, sample 7406, is overlaid by an accumulation deposit, MU2, and an accumulation deposit that has formed from the use of mats, MU1. The accumulation deposit contains low abundances (<5 per cent for each type) of charred wood, amorphous charred organics, burnt sediment aggregates and dung. The more abundant and diverse range of inclusions in comparison with other buildings might be explained by the location of this accumulation deposit close to the edge of the roundhouse floor, where the residues have escaped cleaning (Banerjea *et al.* 2015b). The range of activities represented by the residues mainly relates to the hearth; the dung could suggest animals temporarily slept in the building, or that dung had been brought into the building to be used as fuel.

STRUCTURE 30

Samples 3381, 3382 and 3383 were collected from a rubified surface, context 7975, within Structure 30 (FIG. 307). Sample 3381 was collected adjacent to the hearth and 3382 and 3383 are further away, almost equidistant. Micromorphological analysis has revealed that, in all three samples, context 7975 is neither one single stratigraphic unit and so does not represent a single depositional event in the roundhouse, nor is it a floor surface (Tables 66 and 129). Sample 3381 comprises seven microstratigraphic units with MU7 at the base and MU1 at the top of the sample, and the deposit types are: rake-out material from the base of the hearth, MU5 and MU7; accumulation, MU6, and accumulation that has been scorched post-deposition, MU2; mixed rake-out from the base of the hearth and accumulation, which has been scorched post-deposition, MU3 and MU4; and a vitrified earthen floor surface at the top of the sample, MU1.

Sample 3382 comprises three microstratigraphic units with MU3 at the base and MU1 at the top of the sample, and the deposit types are all rake-out deposits with MU1 from the base of the hearth. Sample 3383 also comprises microstratigraphic units with MU3 at the base and MU1 at the top of the sample; the deposit types are: a mixed levelling deposit and hearth rake-out at the base, MU3; and rake-out deposits, MU2 and MU1.

The only primary accumulation deposits occur in sample 3381, adjacent to the hearth area. These contain very low abundances of activity residues: burnt sediment aggregates, <10 per cent, and burnt glauconite, 20 per cent. The rake-out deposits produced slightly more information about the use of the hearths. They predominantly contain burnt glauconite minerals, charred wood and burnt sediment aggregates. However, in sample 3382 they also contained burnt and non-burnt bone and burnt dung, which probably represents the grilling of meat on the hearth and the use of dung as fuel. The other residues in the rake-out deposits show combustion features produced at a range of temperatures, which could indicate the hearth was multi-purpose: glauconite burnt <800°C, and also other combustion features indicating lower temperatures such as charred wood, fuel-ash slag, ash and melted silica (Mallol *et al.* 2017).

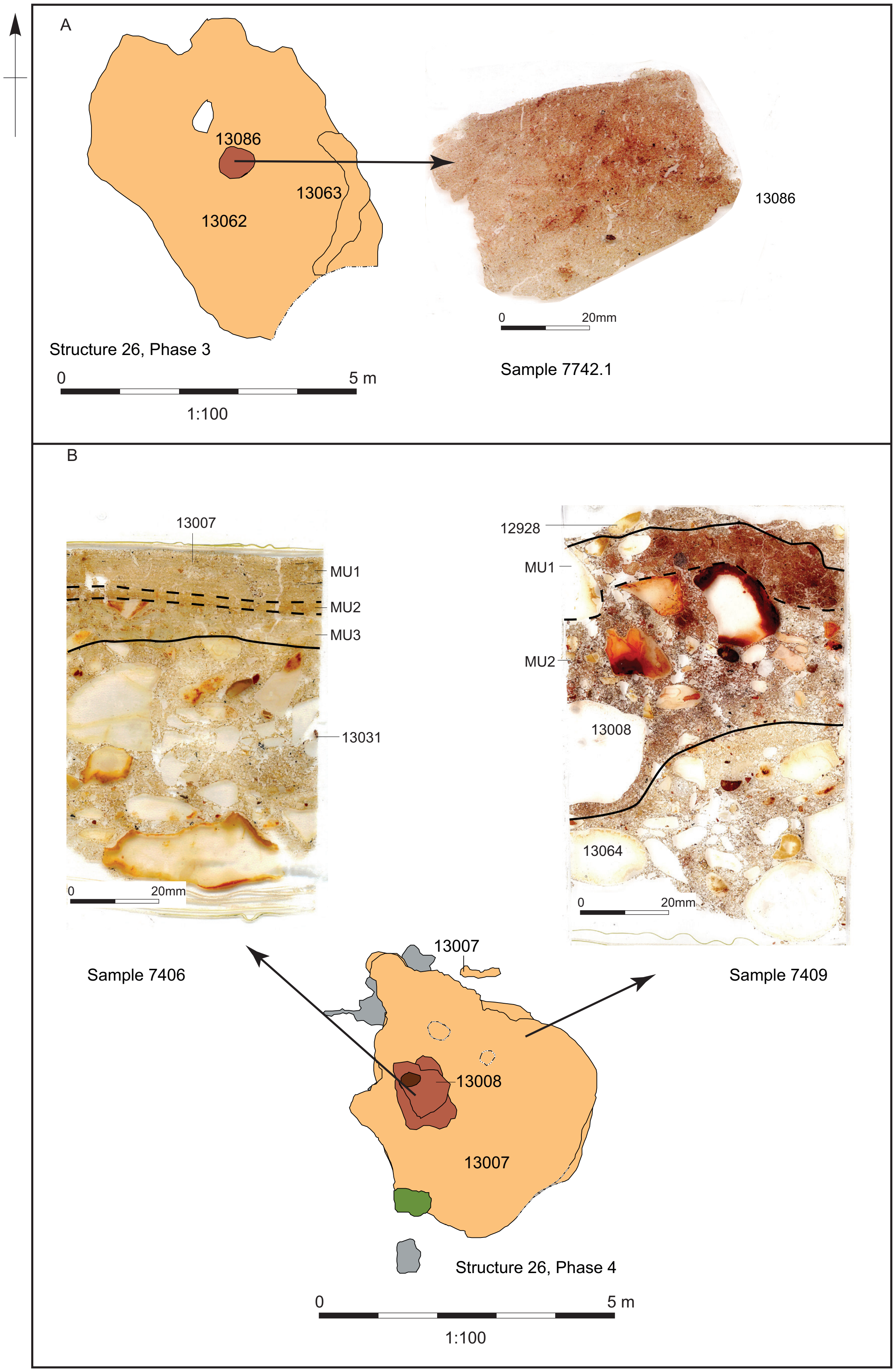

FIG. 306. The location of the micromorphology samples through contexts in Structure 26 and their associated slides.

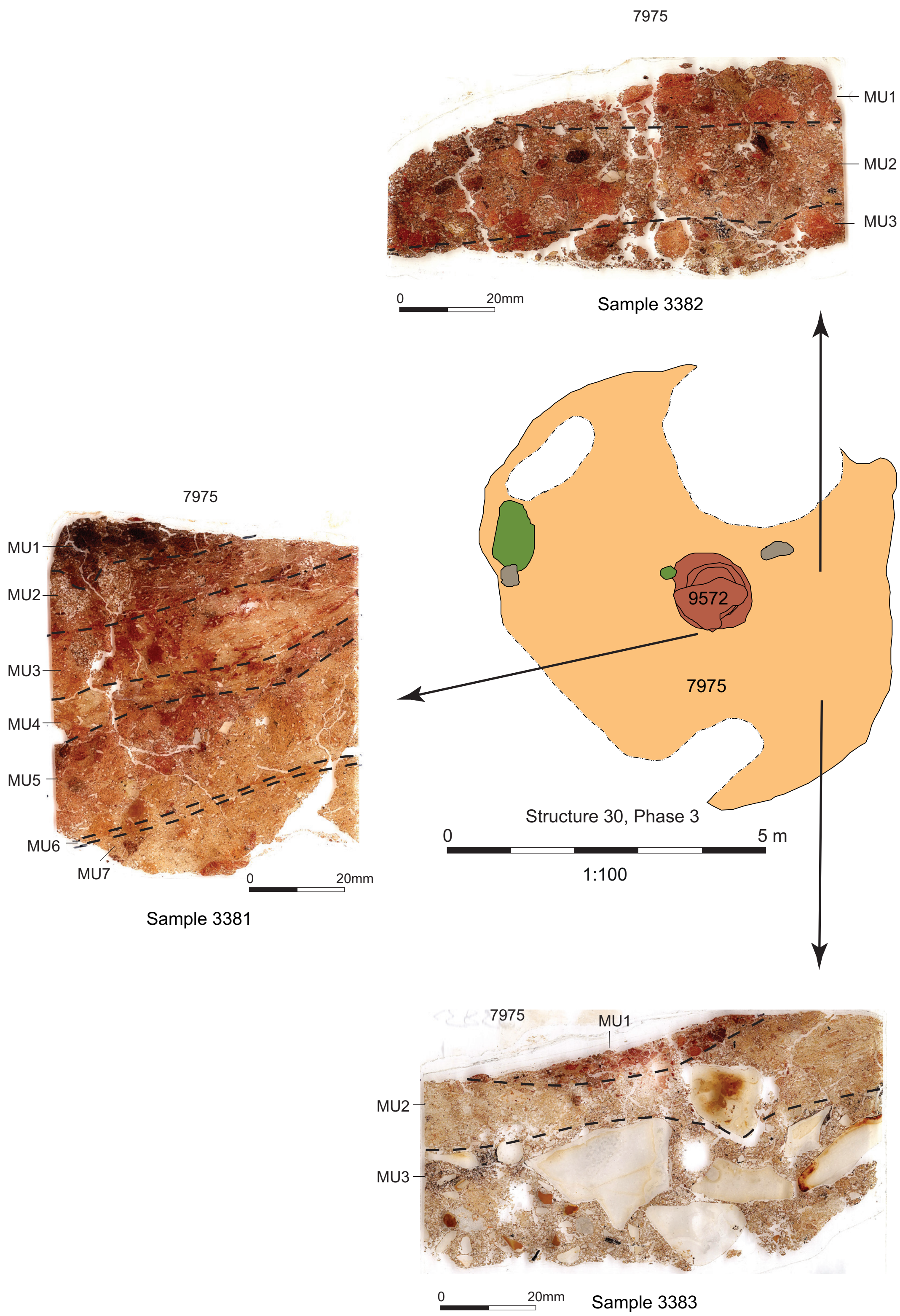

FIG. 307. The location of the micromorphology samples through contexts in Structure 30 and their associated slides.

ZONE 4

STRUCTURE 31

The burnt area of floor 15962 within Structure 31, field context 15900, that was sampled was considered to have been used as a hearth. The central zone had been heated to extreme temperatures — baking the clay hard, which suggested that this represents the remains of an industrial use hearth. 15900 has been separated by micromorphological analysis into two microstratigraphic units and MU1 is the vitrified or scorched surface of the floor. The temperature effects based on thin-section analysis show the temperature changes on the sediment lowered in MU2. MU1, sample 10978, is optically comparable with sediment fired >1200°C, and MU2 with sediment fired between 300 and 1000°C. These high burning temperatures could suggest that industrial activities took place on this hearth and continued within ERTB8, a later multi-phased building with several hearths, which has produced geochemical enrichments from hearths indicating non-ferrous metal-working (Cook *et al.* 2014). Micromorphology has shown that this was a poorly maintained structure where hearth debris was allowed to build up, suggesting it served as more of a workshop space than a domestic one, which are by comparison better maintained (Banerjea 2011a; see further below, p. 000).

CONCLUSIONS

ARCHITECTURE AND MATERIALS

The construction materials that have been identified and examined by micromorphological analysis relate to the levelling of the surface prior to construction of the building and preparation of internal floor surfaces. The materials that were used in these activities are similar to those in later buildings at Silchester, with the exception of lime-based materials as these were not identified in the micromorphological analysis from Structures 19, 24, 26 and 30 (Banerjea 2011a; b; Banerjea *et al.* 2015a).

Levelling deposits are mainly gravel-based, as with later periods. An earthen sub-floor is also used in Structure 24. In Period 2, specifically in ERTB1, recycled earthen floor materials are used as a sub-floor. The earthen floors are prepared using materials and methods similar to those in Periods 2 and 3. The floor fabric is consistent with the composition of the surface geology surrounding Silchester: London Clay, Bagshot Beds and Bracklesham Beds. The preparation method is similar to that identified in Roman London, whereby slabs of 'brickearth' are thought to have been cut and laid as flooring (Goldberg and Macphail 2006). Structure 24 has excellent preservation and survival of the floors, their repairs and of a mica-pigmented rendered surface to one of the floors. The use, or perhaps the survival, of pigmented earthen floor renders is rare at Silchester, with the only other example from ERTB5 where glauconite was used to produce the greenish blue colour of the floor (Banerjea 2011a).

ACTIVITIES WITHIN BUILDINGS

There is very little primary refuse within the buildings, especially within Structures 24 and 30, but rake-out deposits produced building-specific collections of residues. Those residues that do exist mainly relate to the fuels used and cooking activities on the hearths. The deposits from Structures 19 and 26 produced the most abundant activity residues. In Structure 19 these could relate to the disposal of crop-processing waste on the hearth or its use as fuel. The, albeit low, presence of dung within Structure 26 could suggest that animals temporarily slept in the building, or that it was brought in as fuel.

Structures 24 and 30 show evidence for high-temperature burning through the alteration of the sediment and components such as burnt glauconite. The samples from Structure 30 show the build-up of rake-out deposits relating to intensive hearth activity and burning at temperatures up to 1000°C. Structure 24, however, seems to have been destroyed by either deliberate or accidental fire on two occasions. The destruction of the building by fire could be a method of clearing the area for a new phase of construction.

MAINTENANCE OF BUILDINGS

Structures 19, 24, 26 and 30 were all maintained to different standards. The samples from Structure 30 show a build-up of rake-out residues in and around the hearth area. The formation of discard deposits in Structures 19 and 26 could indicate periods of abandonment or partial abandonment within these buildings as if they had been used as a place to discard refuse, and that it had not been cleaned away.

Sediment accumulation from the use of mats has been identified in Structures 19, 24 and 26. The use of mats could explain the absence of high abundances of activity residues within these buildings as mats are often shaken outside, or out of the door, to remove accumulated dust and refuse. This highlights the importance of sampling the thresholds of buildings as also attested through experimental archaeology (Banerjea *et al.* 2015b); the survival of the accumulation deposit along the outer edge of Structure 19 also shows that this is a key location to sample residues that have escaped sweeping (Banerjea *et al.* 2015b). The profile through Structure 24 is a key sequence for illustrating maintenance practices and the use of mats.

Sample 5297 and the occupation from Structure 24 stand out as being different from Structures 19, 26 and 30, with well-preserved, and sometimes rendered/painted, earthen floor plasters and a dynamic process of modification following burning events that seem to relate to destruction (accidental or deliberate).

In comparison with later occupation in Insula IX (Banerjea 2011a; b; Banerjea *et al.* 2015a), abundances and diversity of types of occupation residues are low. Interestingly, the micromorphological analysis of refuse disposal during Period 0 (Banerjea 2018) showed that the intensity of occupation in the early town was very low level, again with little build-up of refuse in pits, which may have been single use. It is possible to see the gradual development of Calleva as an urban centre through the examination of its microstratigraphy and the build-up in the amounts of refuse in the town, which arises from an increase in its population and of craft and food production activities.