Using experimental archaeology and micromorphology to reconstruct timber-framed buildings from Roman Silchester: a new approach

Rowena Y. Banerjea, Michael Fulford, Martin Bell, Amanda Clarke & Wendy Matthews*

Determining the internal layout of archaeological structures and their uses has always been challenging, particularly in timber-framed or earthen-walled buildings where doorways and divisions are difficult to trace. In temperate conditions, soil-formation processes may hold the key to understanding how buildings were used. The abandoned Roman town of Silchester, UK, provides a case study for testing a new approach that combines experimental archaeology and micromorphology. The results show that this technique can provide clarity to previously uncertain features of urban architecture.

Keywords: Roman Britain, urban structures, chronologies of architecture, formation processes

Introduction

A new approach has been developed to reconstruct the architectural layouts of timber-framed and earthen-walled early Roman urban structures. Unlike masonry buildings with clearly defined walls, the interpretation of these structures can be particularly problematic (Fulford 2012: 259). When reconstructing building plans, there has been a tendency to 'fill in the gaps' between earthen walls and post-holes (e.g. Frere 1972: fig. 8; Perring 1987: fig. 65; Millett 1990: fig. 40; Hill & Rowsome 2011: fig. 181). Determining the internal layout of archaeological buildings requires the identification of residual superstructure components (evidence for which is often absent), internal floor surfaces (where they survive),

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hearths and the differentiation between internal and external areas (Carver 1987; Fulford 2012: 258–60). The approach advocated here combines experimental archaeology and thin section micromorphology to provide more robust interpretations of roofed, unroofed and semi-open spaces, and for the locations of doorways. In order to understand fully the structural components and architectural evidence, it is important to classify occupation and accumulation deposits correctly during excavation. In addition, a clear understanding of formation processes enables reconstruction of dynamic chronologies of architecture and often repeated, diachronic use of structures (Carver 1987: 10; La Motta & Schiffer 1999; Fulford 2012: 258). The ability to reconstruct the architectural layouts of early Roman urban structures is an important part of understanding the structuring of activities and the spatial organisation of households. In comparison with public buildings and villas, little work has been done on residential space within Romano-British towns (Millett 2001: 64). In addition, to chart the planning of the earliest stages of Roman urban development, the precise measurements of individual buildings and properties are essential (Burnham *et al.* 2001: 72–73). It is particularly important, therefore, to understand each stage in the development of domestic urban properties.

The extent to which building plans are retrieved in Romano-British archaeology is often limited by the spatial constraints of rescue excavation and by the bias of antiquarian excavation towards monumental buildings (Perring 2002). In Britain, the nature of developer-funded rescue archaeology has placed inevitable constraints on the evaluation of spatial relationships within towns, as rescue archaeology tends to be more 'keyhole' in excavation strategy, with an emphasis on the depth of stratigraphy. Additionally, there is a tendency to report buildings in the form of a stratigraphic narrative, rather than in terms of their use of space (Fulford 2012: 257). Frere's excavations at Verulamium between 1955 and 1961 marked the beginnings of open-area excavation (Fulford *et al.* 2006: 7–8). They produced structures with significant depth and complexity, specifically a sequence of timber-framed, and later masonry, structures in Insula XIV (Frere 1972).

Silchester (Hampshire, UK) is the site of the Roman regional centre or *civitas* capital of *Calleva Atrebatum* (Figure 1). Unlike the majority of Roman towns in Britain, which saw subsequent development from the medieval period up to the present, Silchester was abandoned and has remained a 'greenfield' site. It became the focus of antiquarian interest in the later nineteenth century when a sustained project (1890–1909) was initiated to recover the compete plan of a Roman town (Boon 1974). Fortunately, these excavations were relatively superficial, allowing the possibility for modern archaeology with stratigraphic and geoarchaeological methodologies to explore the development and changing character of the town from Iron Age origins to post-Roman abandonment in much greater depth. With such objectives, the Silchester Town Life Project was initiated in 1997, focusing on a large area (3000m^2) of Insula IX. The fieldwork was completed in 2014. While the mid and later Roman archaeology has now been published (Fulford *et al.* 2006; Fulford & Clarke 2011), work continues on the publication of the Iron Age and early Roman sequences (periods 0–2). The research presented here is mostly associated with the timber buildings (Figure 2) of the as yet unpublished period 2 (AD 70/80–125/50), but also of the period 3 (AD 125/50–200)

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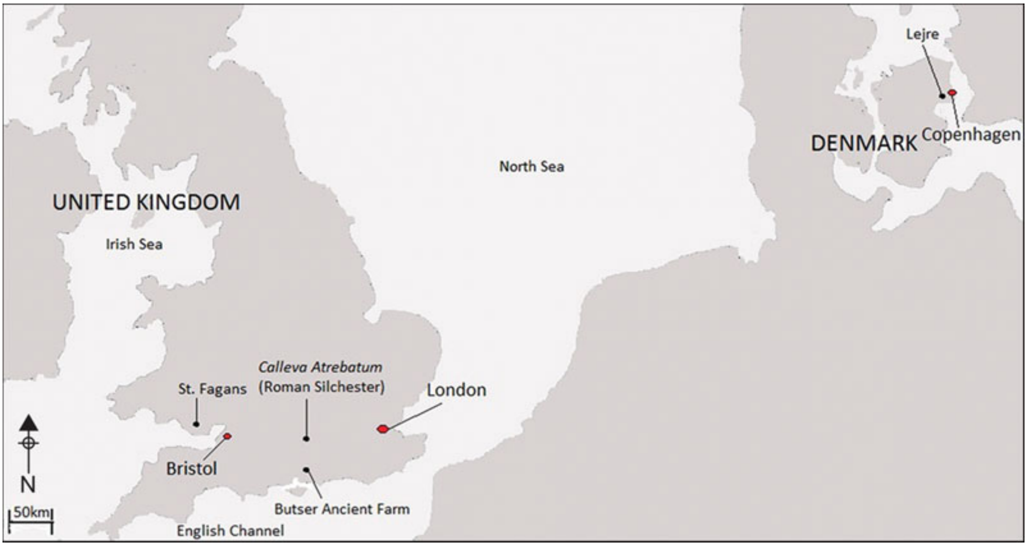

Figure 1. Location of experimental sites (Butser Ancient Farm and St Fagans, UK, and Lejre, Denmark) and Roman Silchester.

occupation (Fulford & Clarke 2011). It complements ongoing research on the geochemistry of the period 2 buildings (Cook *et al.* 2014). These timber buildings have provided a unique opportunity to study the internal spatial and chronological relationships, and to compare the spatial and chronological relationships between buildings using a geoarchaeological approach (Banerjea 2011; Cook 2011).

The integration of open-area excavation at Silchester, experimental archaeology from buildings at Butser Ancient Farm and St Fagans in the UK, and Lejre in Denmark (Figure 1), and micromorphology has enabled more robust interpretations to be made of architectural layouts of buildings at Roman Silchester. In some spaces at Silchester, archaeological features relating to super-structure were absent, and the nature of the roofs was unknown. Looking at the formation processes within the experimental hut floors using micromorphology (Banerjea *et al.* 2015) has helped to interpret the archaeological record at Roman Silchester.

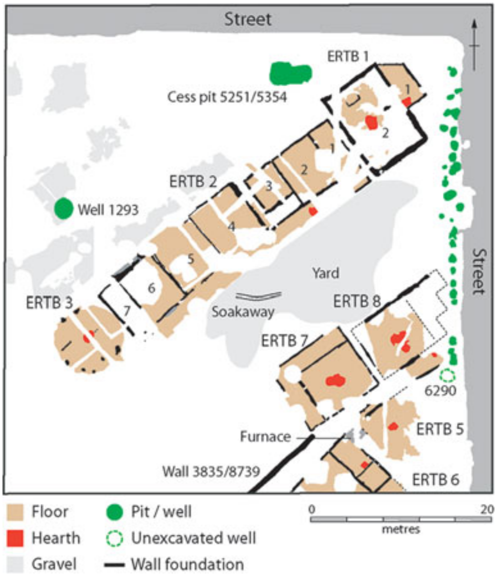

Figure 2. Excavation plan of period 2 buildings, ERTB1, ERTB5 and ERTB8, Silchester (Fulford & Clarke 2009); drawing by Margaret Mathews.

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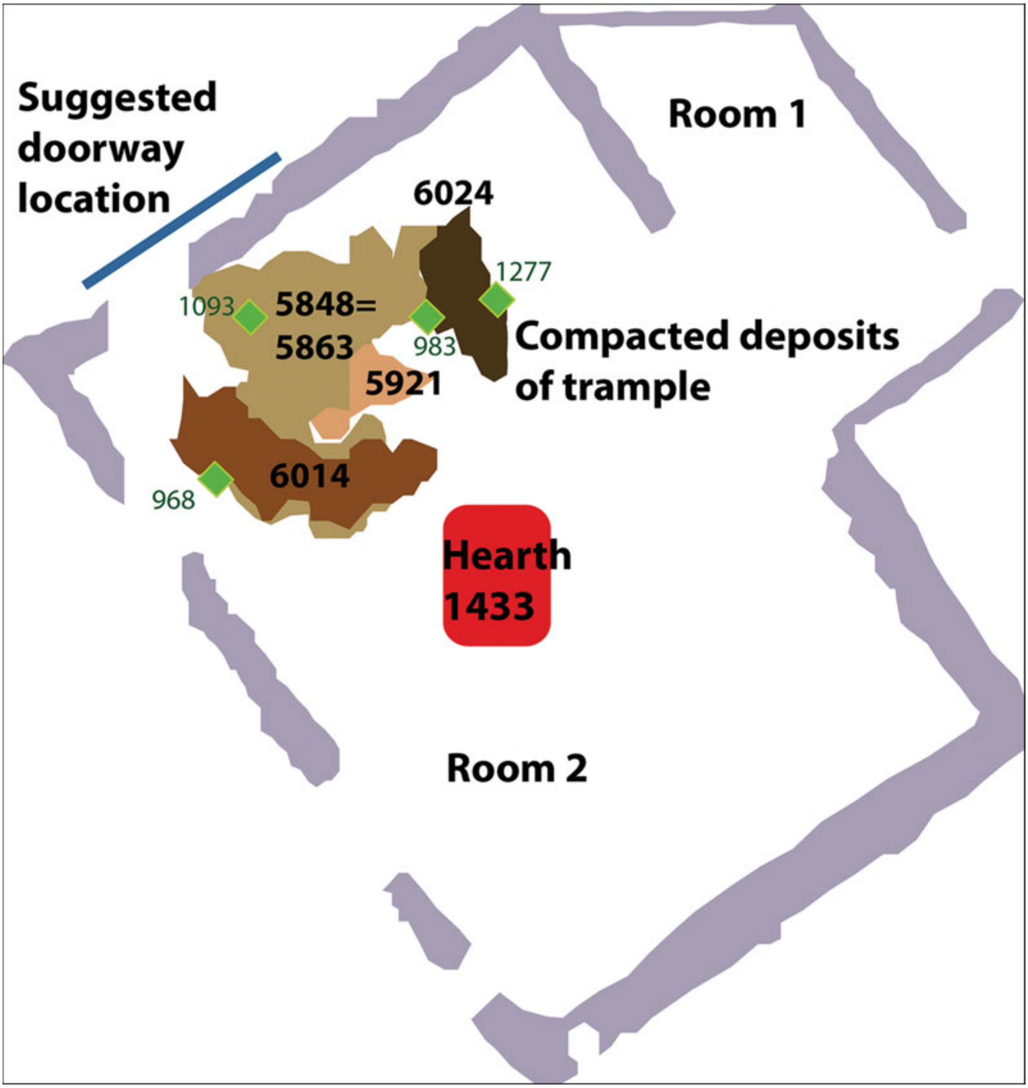

Figure 3. The location of trampled sediment and the suggested location of the doorway within building ERTB1; the superimposed trample deposits show the location of the doorway through time within this multi-phase structure; the truncation of the beam-slots (grey) is a result of Victorian excavation trenches; sample locations are marked in green.

Micromorphology is well established as a tool for interpreting archaeological site-formation processes. This technique has been widely applied to the investigation of the use of space within buildings (e.g. Matthews 1995; Matthews *et al.* 1997; Shahack-Gross *et al.* 2005; Milek & French 2007; Karkanas & Efstratiou 2009; Jones *et al.* 2010), as well as external spaces and middening practices (Simpson & Barrett 1996; Shillito & Matthews 2013; Shillito & Ryan 2013). The application of micromorphology to Roman urban archaeology has, up to now, been largely

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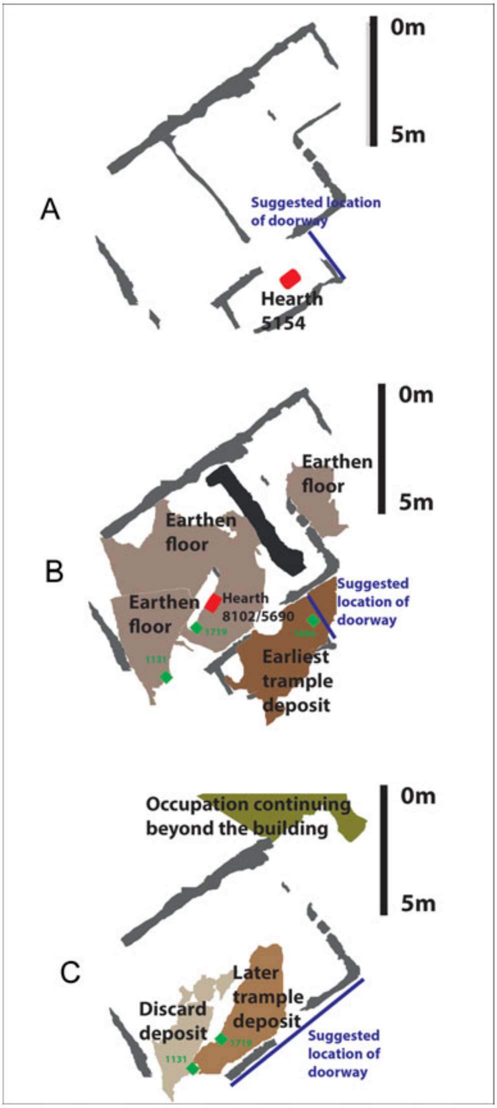

Figure 4. The structural modifications of building ERTB8: a) the initial layout of the earthen walls (grey) and hearth (8154); b) the earliest deposit of trample within the doorway at a point of structural modification; c) the later deposit of trample and the new doorway location. Truncations to the earthen walls are a result of excavation trenches that were created by Victorian excavators, and cuts by the foundation trenches of later Roman structures; sample locations are marked in green.

limited to the study of dark earths to determine their formation processes and to identify traces of past activities (e.g. Macphail 1994; Macphail *et al.* 2003a). This study aims to inform the architectural interpretation of urban spaces that may have been trampled, damp, open or partially open and, as a result, susceptible to and affected by weathering, erosion and disturbance. It is therefore important to understand processes such as trampling (Gé *et al.* 1993), clay translocation and coatings (Courty *et al.* 1989; French 2003: 123, 156; Goldberg & Macphail 2006: 356–58), the formation of new minerals as a result of diagenesis and decay of inclusions such as ash, bone and dung (Weiner 2010), and mesofaunal bioturbation (Macphail 1994; Canti 2003, 2007).

Experimental archaeology can play an important role in advancing archaeological interpretations through creating a database of reference material from known activity areas and modern analogues. These data can be used to provide more robust interpretations of the archaeological record (Goldberg & Macphail 2006: 247–48; Macphail & Linderholm 2011: 461; Banerjea *et al.* 2015), in a similar way as when applied to ethnoarchaeological research (Matthews *et al.* 2000; Villagran *et al.* 2011; Milek 2012). Geoarchaeology is a pathway of research that has brought together ethnoarchaeology and experimental archaeology to interpret site-formation processes and to understand the formation of refuse assemblages, in order to identify the use of space and the structuring of activities within households. It is necessary, however, for experimental research to have clear research designs and scientific rationales (Bell 2009) to feed back into the process of interpreting the archaeological record, to provide the facility for the physical testing of hypotheses and also to suggest new systems of data recovery and recording (Reynolds 1979: 83). Pedological and sedimentological investigations were generally not

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considered at the inception of many experimental archaeology sites (Crowther *et al.* 1996: 114). Despite this, when applied to an experimental context, micromorphology has identified the mechanisms and pathways by which materials are transported in occupation contexts (Banerjea *et al.* 2015): activity areas such as animal husbandry (Macphail *et al.* 2004; Canti *et al.* 2006; Macphail *et al.* 2006; Macphail & Crowther 2011; Banerjea *et al.* 2015); short-term changes to soils and sediments (Crowther *et al.* 1996; Macphail *et al.* 2003b); and post-depositional alterations to occupation deposits (Banerjea *et al.* 2015).

Field methodology

Most of the experimental buildings investigated in this research were constructed 16 years prior to sampling and have housed a range of activity spaces over their lifetime. Micromorphological examination of structures at Butser, St Fagans and Lejre has enabled formation processes within buildings to be studied in a temperate climate in different geological settings, providing examples that inform the investigation and interpretation of activity traces in a range of archaeological settlement contexts on several substrates. These experimental archaeological contexts enabled targeted examination, at a high chronological resolution, of known activity areas, specific depositional processes and taphonomy within structures at the microstratigraphic scale. Specific processes such as dumping, trampling, decay and collapse were readily observed in the experimental buildings (Banerjea *et al.* 2015). For the experimental data to be applicable to spatial investigations of archaeological urban and settlement sites, samples were collected for micromorphological analysis from key locations within the experimental buildings at Butser, St Fagans and Lejre (Banerjea *et al.* 2015): from roofed, unroofed and semi-open spaces; from damp areas within buildings; and from doorways.

The Insula IX excavation at Silchester enabled micromorphology samples to be collected spatially across several early (ERTBs 1–8) to mid-Roman (MRTB1) timber buildings dating from periods 2–3 (Figures 3, 4 & 5). Despite the opportunities for extensive spatial examination of structures, open-area excavation still encounters problems with the truncation of stratigraphy by features such as the foundations of later buildings and, at Silchester, trenches from Antiquarian excavations (Fulford & Clarke 2002). Yet the truncations made through timber-framed structures have provided windows into the stratigraphy and section-faces from which micromorphology samples have been collected. The coordinates (x, y, z) for each micromorphology sample, with the exception of two samples from MRTB1, were recorded, in order to locate each sample on the site grid plan for the excavation of Insula IX, Silchester. Samples from MRTB1 were recorded to a specific 5 × 5m grid square. Sampling was targeted to collect levelling deposits, the earthen and mortar floors of buildings, and occupation deposits. The archaeological structures featured in this research (Figure 2) are all similar in shape and overall design: square or rectangular with central hearths. Experimental structures at Lejre were also square or rectangular with central hearths, and structures at Butser and St Fagans were circular with central hearths. At Silchester, where building form diverges from the regular shape, for example, the additions to ERTB1 and ERTB8, the irregular shape was probably

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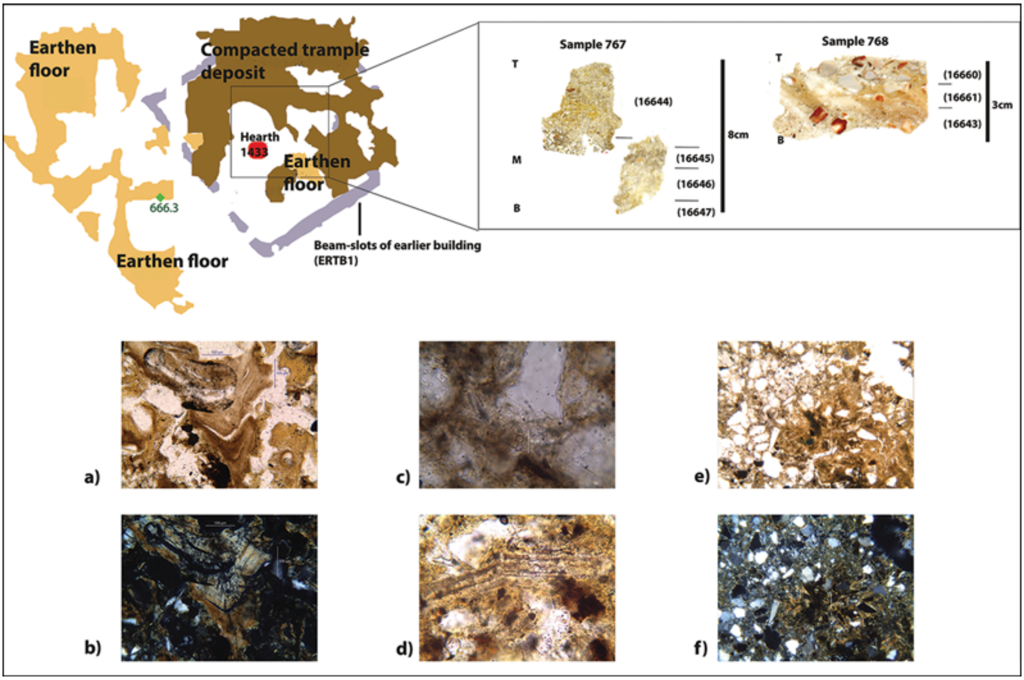

Figure 5. Plan of building MRTB 1 (top left): the square box shows a 5 × 5m grid square where samples 767 and 768 (top right) were collected from the deposit of compacted trample; note the beam-slots (grey) of the underlying structure, building ERTB1 (Figure 3). Microlaminated silty clay coatings (a & b) are evidence of repeated weathering episodes within trample deposits in this area. Trample deposits in samples 767 and 768 (top right) comprise super-imposed micro-lenses of hearth debris, including heat-fractured flints, minerogenic sediment, herbivore dung (c and d) and vivianite (e & f). These micro-lenses were not identified during excavation and were thought to be a single deposit that was originally interpreted as a floor surface; the location of sample 666.3 is marked in green.

because they respected the main road that was in proximity and were shaped to fit around it.

Laboratory methodology

Micromorphology samples (from Roman Silchester and all of the experimental sites) were prepared in the Microanalysis Unit at the University of Reading. The procedure followed is the standard protocol for thin-section preparation (Murphy 1986). Samples were oven-dried at 40°C, and then impregnated with epoxy resin while under vacuum. Slides were prepared to the standard geological thickness of 30μm.

Micromorphological investigation was carried out using a Leica DMLP polarising microscope at magnifications of ×40–400 under plane polarised light (PPL), crossed polarised light (XPL), and 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). Photomicrographs were taken using a Leica camera attached to the Leica DMLP microscope.

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Results and discussion

Micromorphological characteristics attributed to both trampling as a formation process and as a post-depositional alteration have been identified in experimental and archaeological sediments at these temperate sites (Table 1). In order for compacted trample deposits to form, experimental archaeological research has demonstrated that damp environmental conditions must be present. Building collapse or the partial removal of roofs also played an integral role in the formation of internal deposits of compacted trample (Banerjea *et al.* 2015). The locations of trampled sediment in archaeological buildings have been used to identify wet areas of buildings such as doorways (Figures 3 & 4) or semi-open spaces (Figure 5) in the archaeological buildings at Roman Silchester; differentiation between the two may be determined by the type of clay coatings.

Identifying doorways

The nature of the urban archaeological record in Britain makes it difficult to identify doorways from excavated field evidence alone; full plans may not be present or walls may not survive to sufficient height (Perring 1987; Perring 2002). Porched entrances in Iron Age houses make doorways easier to identify (Cunliffe 1978; Perring 2002). In addition, doorways may be particularly difficult to identify from trace archaeology. When dealing with timber-framed buildings, faint linear colour distinctions left by sill-beams may be all that remain of a particular structure (Carver 1987).

At Wroxeter, as part of excavations of the Macellum and Roman Baths, Ellis suggested that the 'trampled clay' area between rooms 5 and 8 in building 3 may have marked the doorway (Ellis 2000: 14). Observations from the Butser, St Fagans and Lejre experimental sites support Ellis's suggestion, showing that in temperate regions, internal doorways can be wet, trampled areas (Banerjea *et al.* 2015). In experimental archaeology, compacted trample deposits have been observed to form in doorways and semi-open spaces (Banerjea *et al.* 2015). Doorways are also catchment areas for sediment from both outside and inside the buildings, as observed in the semi-arid site of Saar, Bahrain (Matthews & French 2005). At Lejre, 'pitting' in the surface topography of the floor of building 1 (Iron Age village) is reported to have been caused by several factors: rain erosion, human and animal trampling, and abrasion by sweeping (Banerjea *et al.* 2015). In experimental and archaeological buildings, potential indicators of doorways from sediments at temperate sites include compacted trample deposits or mixed trample and accumulation deposits (Table 1), and post-depositional features such as dusty impure or silty clay coatings, which may be microlaminated if the area is repeatedly rained on heavily; for example, a semi-open space. These indicators co-occur archaeologically in ERTB1, ERTB8 and MRTB1, and show features of weathering and decay processes such as neomineral formations and organic staining (Table 1). The clearest evidence for the identification of a doorway is within ERTB1. Successive layers of trample built up in one specific part of ERTB1 (Figure 3), and the presence of dusty impure clay coatings suggested that this area of the building was damp. Silty clay coatings that are poorly sorted, have a weak organisation, diffuse extinction and an absence of lamination are also termed dusty impure clay coatings, and are indicative of turbulent hydraulic conditions (Courty *et al.* 1989).

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Table 1. Post-depositional alterations within experimental (E) and archaeological deposits (A) of trampled sediment.

						Weathering							Trampling			
Contextual information						Translocation			Chemical alteration		Decay		Microstructure effects		Mesofaunal bioturbation Excremental pedofeatures	
Deposit type number	Sample number	Context number	Experimental (E)/ Archaeological (A)	Site	Building	Dusty impure clay coatings	Silty clay coatings: microlaminated	Iron	Vivianite neomineral formation	Manganese neomineral formation	Organic staining	Spherical fungal spores	Cracks	Mesofaunal bioturbation	Insect cast	Earthworm granule
Compacted trample	BLD1	LD004	E	Butser	LBD R/H			••		•	•••		•			
	BLD3	LD003	E	Butser	LBD R/H	•••				•••	•••			••••	•	
	768	16660	A	Silchester	MRTB1		•••••		•••		••			•••		
	768	16661	A	Silchester	MRTB1			••••	•••					••••		
	768	16643	A	Silchester	MRTB1				•••		•••	•••		••••		
	767	16644	A	Silchester	MRTB1		•••••		•••••		••••	••	••	••••		
	767	16645	A	Silchester	MRTB1		••••				•••••			••••		
	767	16646	A	Silchester	MRTB1		•••••		•••••		••••	••				
	767	16647	A	Silchester	MRTB1		••••		•••••		••••	••				
	983	5848 = 5863	A	Silchester	ERTB1/ MRTB1	••••		••••	•••				•••	••••		
	1093	5921	A	Silchester	ERTB1	•••	••	••								
	968	16657	A	Silchester	ERTB1	•••		•	•••				••	••		
	968	16659	A	Silchester	ERTB1	••		••	•••					••••		

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Table 1. Continued.

						Weathering						Trampling			
Contextual information						Translocation			Chemical alteration		Decay		Microstructure effects		Mesofaunal bioturbation Excremental pedofeatures	
Deposit type number	Sample number	Context number	Experimental (E)/ Archaeological (A)	Site	Building	Dusty impure clay coatings	Silty clay coatings: microlaminated	Iron	Vivianite neomineral formation	Manganese neomineral formation	Organic staining	Spherical fungal spores	Cracks	Mesofaunal bioturbation	Insect cast	Earthworm granule
	1277	16662	A	Silchester	ERTB1	•••			••••					••••		
	1277	16663	A	Silchester	ERTB1	••			••••					••••		
	1666	16652	A	Silchester	ERTB8	••	•	•	••••	••				••		
	1719	16673	A	Silchester	ERTB8	••••		•••	••	•••			•	••••		
	1719	16672	A	Silchester	ERTB8	••••		•••	•••	•••				••••		
	1718	16674	A	Silchester	ERTB8	••••	•••	••	•••	••••	•••			••••	•	
Mixed trample/ accumulation	L45	016	E	Lejre	Sunken shack	•	••••				•			•••••		
	SF71	46	E	St Fagans	Moel-y-Gaer R/H			•••			•••	••••		•••		
	730.1	4232 = 4245	A	Silchester	ERTB1	•••	•••	••	••••	••••	•	••		•••••		

Key for frequency: ●●●●● = >20%; ●●●● = 10–20%; ●●● = 5–10%; ●● = 2–5%; ● = <2%

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On an archaeological settlement, the presence of dusty impure clay coatings can indicate anthropogenic disturbance processes such as trampling and dumping (Goldberg & Macphail 2006).

ERTB8 also contains compacted trample layers with dusty impure clay coatings and presents another case study for defining doorways in archaeological buildings (Figure 4). Post-excavation work on the phasing and stratigraphy for ERTB8 is not yet completed. Micromorphology has, however, identified units of compacted trample (Table 1), which inform the interpretation of this dynamic and evolving building. It is probable that the earliest trample unit, context 16652, which overlies hearth 8154 (Figure 4a & b), formed once the hearth fell out of use and this room became an access route into the building. Later, this access route fell out of use and was covered with gravel levelling, perhaps to form a yard and the doorway to the building was moved to the edge of the later compacted trample unit, context 6265 (Figure 4c).

Identifying semi-open spaces

Partially roofed or walled spaces in a temperate urban archaeological site can be identified by the presence of clay translocation, particularly microlaminated clay coatings, within units of compacted trample and discard deposit types, and deposition of wind- or water-sorted sediment. As the fields overlying the Roman town of Silchester were previously used as arable land until 1979, it is important to consider that translocated clays may post-date a site by many hundreds or thousands of years, relating to processes such as land clearance, disturbance by ploughing and a fluctuating water table (French 2003; Goldberg & Macphail 2006). Examination of the distribution of clay coatings, and study of their formation using experimental archaeology, has, however, enabled microlaminated silty clay coatings to be identified in very specific locations within buildings (Table 1; Figure 5); for example, in MRTB1 at Silchester they occur within the deposits of compacted trample and a discard deposit associated with the abandonment of the structure, but not within the constructed earthen floor surface (sample 666.3) inside the building (Figure 5). The analysis of deposits within the experimental buildings has shown that silty clay particles were mobilised due to very localised redox conditions, associated with the decay of organic matter, and occurred with deposits of trampled material during or at the end of the use of particular areas and buildings; for example, after roof removal (Banerjea *et al.* 2015).

The evidence for microlaminated silty clay coatings may indicate that ERTB1, room 1, ERTB8 and MRTB1 had wetter conditions (Table 1). In MRTB1, the microlaminated clay coatings are localised within compacted trampled layers (Figure 5a & b), suggesting that this space was partially roofed or without walls (given the absence of super-structural components), perhaps a shelter, which was a multi-functional space with a hearth and where livestock (herbivores) were kept. Compacted trample deposits are characterised by parallel orientation of soft materials such as plant remains and dung (Figure 5c & d), implying that downward compression aligned these malleable inclusions parallel with the surface of the context below (Banerjea *et al.* 2015). Harder materials such as rock fragments, minerals and metallurgical residues are unoriented (not aligned to any other specific features within deposits), randomly distributed and do not share orientation with any other components

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(Banerjea *et al.* 2015). The deposit of 'clods' of sediment from the soles of feet formed lenses of sediment when compressed during deposition on comparatively dry surfaces in roofed spaces. Had the area been completely unroofed it is unlikely that the compacted material would have built up in layers but rather would have been churned into one homogeneous unit, as has been observed at semi-arid sites (Matthews 1995); failing roofs can radically transform occupation deposits within buildings and eventually lead to soil development, which may resemble a 'dark earth', as observed on a temperate experimental site at Lejre (Banerjea *et al.* 2015). The effects of failing roofs could have significant implications for the identification of structures in the archaeological record at temperate sites in terms of the survival of evidence.

In ERTB8, the microlaminated silty clay coatings occur within hearth rake-out deposits and *in situ* hearth ashes from hearth 8102/5690, and in ERTB1 they occur within accumulation deposits, trampled sediment and *in situ* ashes around hearth 1433 (Figures 3 & 4). In both ERTB1 and ERTB8, this may suggest that activities focused on the hearths, involving trampling around the hearth, the use and spillage of water, and fluctuating redox conditions from decaying organic materials (fuel and food residues), could be the mobilising factors of clay translocation in these units. Experimental research has demonstrated that chemical alterations can also play a key role in the formation of silty clay coatings, where the processes that cause the fluctuations in redox conditions appear to have arisen from chemical changes relating to the decay of organic matter and dung, and the replacement of organics with iron and manganese (Banerjea *et al.* 2015).

Conclusion

Used in conjunction, experimental archaeology and micromorphology have integral roles to play in characterising archaeological deposits and interpreting urban site-formation processes. The comparative analysis of micromorphology from experimental buildings and from Romano-British structures at Silchester has informed the interpretation of their architectural layout. This research has enabled the mapping of dynamic structural modifications and the changing use of urban space through the identification and changing locations of trampled sediment, which reveals changes in the way people moved through structures. In a temperate environment, for successive layers of trampled sediment to build up, it is necessary for conditions within a structure to be damp but not fully open to rain, as this would cause churning of the deposits. The co-occurrence of dusty impure clay coatings and deposits of compacted trample has been linked to the location of doorways, particularly as these deposits have built up, superimposed in a specific location. It has been possible to differentiate between roofed spaces, such as doorways, and those that were semi-open (partially roofed or partially walled), and may have served as shelters, particularly for livestock. Microlaminated silty clay coatings within deposits of trampled sediment within semi-open structures indicated wetter conditions. Identification of the specific micromorphological attributes within trampled sediments can contribute to the interpretation of specific spaces, particularly in locating doorways and in tracing structural modifications within other multi-period urban archaeological sites, and indeed in a variety of settlements with timber-framed or earthen structures.

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