Analysis of Micromorphology Samples from the Iron-Age and Romano-British Site Marcham/Frilford

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Submitted in partial fulfilment of the requirements for the Master of Philosophy Degree in Archaeological Sciences at the Department of archaeology, University of Cambridge

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ABSTRACT

This work investigates a series of micromorphological samples from the Iron Age/ Romano-British site of Marcham/Frilford in Oxfordshire, England. Ten samples were taken focusing on an Iron Age land surface and Romano-British structures. This study was in effect a preliminary assessment of the potential for micromorphological analysis. Results were informative, indicating the presence of floor surfaces, corroded copper and evidence of ancient woodland.

This study has demonstrated the importance of micromorphology in understanding long-term environmental conditions and more specifically in contributing to the understanding of the purpose, use and histories of Roman buildings.

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I am, of course, extremely thankful for all the help from Lewis Helen, of the Department of Continuing Education, University of Oxford. I am grateful for the research materials she provided, including plans and section drawings as well as the samples, without which this dissertation could never have been written. My gratitude also goes to Chris Gosden and Gary Lock, of the University of Oxford, for kindly inviting me to the site Marcham/Frilford, and showing great interest in my work. I am only pleased to be providing them with important information for the overall understanding of this amazing site.

I would also like to show my appreciation to members of the McBurney Laboratory, Department of Archaeology, University of Cambridge, namely Manuel Arroyo-Kalin, Ann-Maria Hart, Karen Milek and Miranda Semple for their enduring patience and support during times when the complex world of micromorphology seemed entirely out of my reach. I am eternally grateful for their friendship and advice, without which I could not have achieved so much. A big thank you to Julie Miller for preparing the thin-sections and making me feel more than welcome in a new working environment.

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INTRODUCTION

Micromorphology enables one to analyse soil and sediment stratigraphies to microscopic levels. The taking of undisturbed samples in Kubiena boxes for the production of sections as thin as thirty micro-metres thick, has had a strong impact on the study of soils and natural as well as anthropogenic sediments. Micromorphology provides a technique with which pedogenic, geologic and anthropogenic processes, both ancient and more recent, can be defined and described in their chronological sequences. In archaeology micromorphology is successfully used in a wide range of investigations, but perhaps more commonly to:

1. detect and explain both natural and cultural formation processes (*sensu* Schiffer 1987);
2. identify construction materials and their provenance;
3. discover the hydrological conditions of the landscape and household environments;
4. help interpret the use of space within a building or room and the use of land around settlements, along with conventional architectural and artefact studies;
5. augment field artefact studies with the recovery of small fragments of artefacts, bones and plant remains that would be missed under normal sampling procedures

For this dissertation I wanted to study an assemblage of thin-sections to further acquaint myself with the use of micromorphology as an investigative technique in archaeology. At the time when I was searching for an adequate group of samples, Dr Helen Lewis, from the Department of Continuing Education, Oxford University, kindly suggested that I should analyse the ten box-samples she had taken from the site of Marcham/Frilford in Oxfordshire, England. Marcham/Frilford is a Romano-British rural religious centre, with origins in the Iron Age and possibly earlier. The ten samples included a palaeosol buried during the early Roman period, and a series of anthropogenic sediments from three different structures. Hence, I began to analyse, describe and interpret the thin-sections, not only as individual entities but also as representative micro-areas of a complex site. This dissertation is, in effect, an assessment of potential for micromorphological analysis at this site. Analysing and describing the thin-sections was long and difficult at first, but fascinating. The more I

observed them, the more I learnt from them, realising the potential wealth of information held in such small portions of an overall site. I found clues relating to all of the five points above, although no conclusive interpretations could be drawn due to the lack of representative samples. Nevertheless, this report adds valuable information for interpreting the site as a whole, as well as specific areas within the site, and corrects the understanding of significant contexts, misinterpreted in the field. This dissertation has also been an extremely rewarding experience, during which I have learnt to use a relatively new investigative technique for the benefits of archaeology. This is one of the first attempts at these kinds of microscopic analysis of a Romano-British site where there are known associated structures (unlike studies of dark earth in Roman and Medieval urban deposits of England (*cf.* Macphail 1981; Macphail 1983; Macphail 1994; Macphail *et al.* in press; Yule 1990)). I hope readers will be left convinced of the potential uses of micromorphology as a research method on sites, whose conclusions should be discussed in conjunction with other archaeological data.

A description of the site, Marcham/Frilford, is presented in the following chapter, along with its history of excavations and changing interpretations. Chapter Three contains all of the contextual information related to the micromorphological samples, helping the reader to understand where the latter come from and what contexts they represent. The relevant features of the thin-sections are described in Chapter Four, whose summary is tabulated from pages twenty-seven to twenty-nine. Chapter Five explains the described features and interprets the samples in terms of natural and anthropogenic processes. All the evidence is then pooled together in Chapter Six, where the data retrieved from the nine thin-sections are more specifically related to the overall site and its surroundings. Recommendations are made for further sampling for micromorphology as well as other useful analysis. The appendix holds a full technical description of all ten samples.

INTRODUCING THE SITE AND ITS HISTORY OF EXCAVATIONS

The current excavations of Marcham/Frilford are in Trendles field (OS 440 960), west of Abingdon, Oxfordshire, England (fig. 1). The bedrock in the area alternates between Jurassic limestone, sand, Kimmeridge clay and Oxford clay (Jarvis 1973, sheet 253). In Trendles field alone, four soil series have been identified: brown earths (Fyfield); surface water gley soils (Kingston); brown calcareous soils (Sherborne), and ground water gley soils (Fladbury) (*ibid.*). The river Ock meanders along the south-west boundary of Trendles field, to join the Thames at Abingdon (Bradford and Goodchild 1939: 3). The site is very close to at least one Roman road (fig. 2).

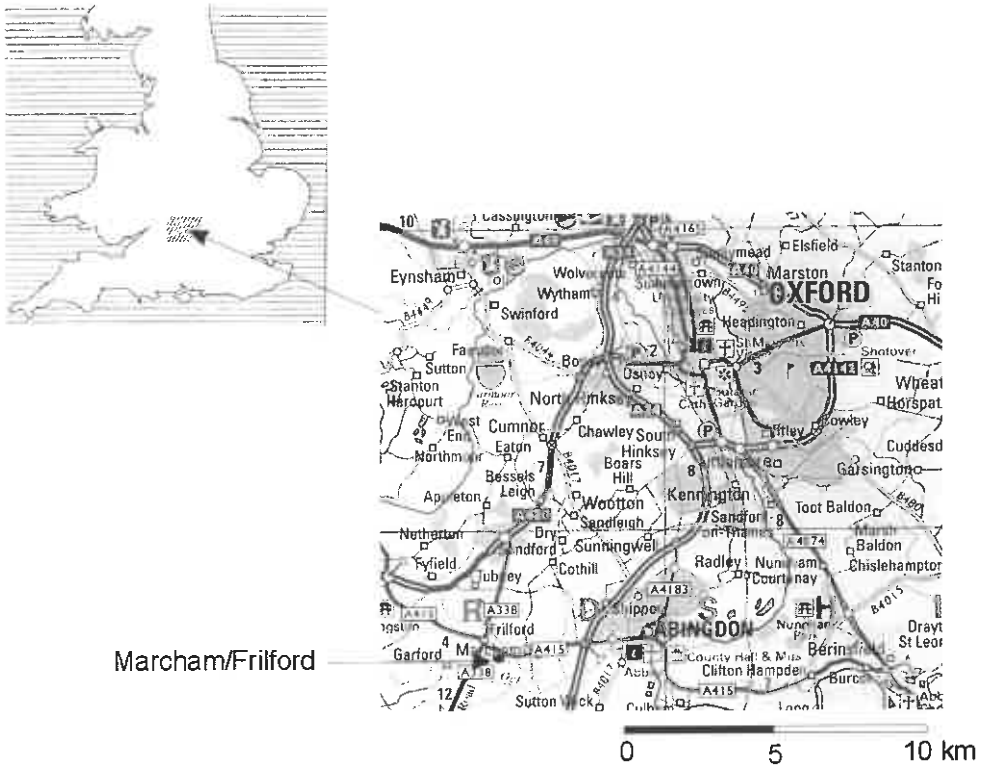


Figure 1: Location of the site (adapted from Road Atlas 2003, 14)

The Romano-British and Anglo-Saxon cemetery was discovered in 1920 by the late Dr. L. H. Dudley Buxton (fig. 2) (Bradford and Goodchild 1939, 54). From 1937-38, Bradford and Goodchild (1939), of the Oxford University Archaeological Society, directed the first excavations in the meadows behind the Noah's Ark Inn at Frilford, "where stray finds of Roman pottery and coins had often been made" (p.1). The area was divided into three sites: A, B and C, which together revealed "a Romano-Celtic Shrine directly overlying an Iron Age settlement" (*ibid.* 27, 3). Site A "included a Romano-Celtic temple with secondary annexes, and a large Late Iron Age hut underneath its north-west corner." (*ibid.* 3). A small quantity of Romano-British sherds was recovered from the hut, and "it is quite evident that Roman wares had hardly begun to filter into the district before the hut's destruction." (*ibid.* 33). The hut was burnt down around A.D. 80-90, and an eastward facing Romano-Celtic temple was immediately built on top, its foundations resting on oolitic limestone. An entrance pathway of gravel and stones was found on the east side of the Temple; "some 78 coins, all of the 4th or 5th centuries" (*ibid.* 32), and various other bronze artefacts were found scattered on its latest phase. Bradford and Goodchild (1939) concluded that the temple gradually ceased to be frequented during the fifth century, with no evident signs of a violent destruction. (Bradford and Goodchild 1939, 1-69).

Site B was where the main Iron Age settlement was uncovered (*ibid.* 6-8). Also discovered was an intrusive late Roman coin-hoard and Anglo-Saxon burial (*ibid.*). The Anglo-Saxons must have "found a large hoard, and left a small residue as an offering to their dead kinsman whose obsequies had led to the unexpected discovery." (*ibid.* 39). (*ibid.* 6-8, 37-9).

On site C, "trial trenches revealed a large circular Romano-British building with an exterior diameter of 36 feet. The building was superimposed directly on a broad horse-shoe shaped Iron Age ditch" (*ibid.* 11). From the latter, a votive plough-share, sword and shield "confirm the site's ritual significance" (*ibid.* 15). The fact that the circular form of the Iron Age ditch was maintained led the authors to suggest that "the religious continuity was not wholly broken" (*ibid.*). Levelling of the Iron Age structure and construction of the Roman Rotunda is thought to have been contemporaneous with the building of the Temple. Unlike the temple, the Rotunda was burnt down, possibly towards the end of the fourth century. (*ibid.* 11-15, 36-7).

Noah's Ark Inn was re-excavated and interpreted by Professor Harding in 1964 (Harding 1972, 62). He argued against continuity from the Iron Age to the Roman period, producing evidence for the construction of the temple in the late second/early third century (*ibid.* 53, 62; Hingley 1985, 204). In a later paper, Harding also refutes the evidence of an Iron Age shrine on site C, suggesting it was domestic (Hingley 1985: 203). Whilst the existence of Iron Age ritual structures at the Noah's Ark Inn is now dubious, Roman religious buildings are undoubtedly present; "rather than representing a wayside shrine, Noah's Ark Inn is in fact an extensive Roman religious complex." (*ibid.* 202). The site of Noah's Ark Inn is now scheduled and protected from any further excavations (fig. 3).

Between 1978 and 1984, Hingley (1985) conducted an archaeological survey of the area surrounding the temple complex (fig. 2). Through aerial photography, the survey revealed the temple's temenos wall; other Roman buildings, including an 'amphitheatre' (which is no longer described as such – see below), and a possible paleochannel (see below) (fig. 3). In 1981 Hingley (1985) opened two trenches in the 'amphitheatre'. The bank around the arena was found to be severely flattened by modern agriculture, whilst, on the inside of the bank, the arena was defined by a stone and mortar wall, surviving in places to a height of forty centimetres. "Trench 2 produced part of the plan of the amphitheatre's southern alcove" (*ibid.* 206), which is still being investigated in current excavations (see below). Dates for the 'amphitheatre' remain inconclusive, although Hingley, by comparison to the Cirencester and Silchester amphitheatres, suggested it was built in the second or third century. (*ibid.* 201-11)

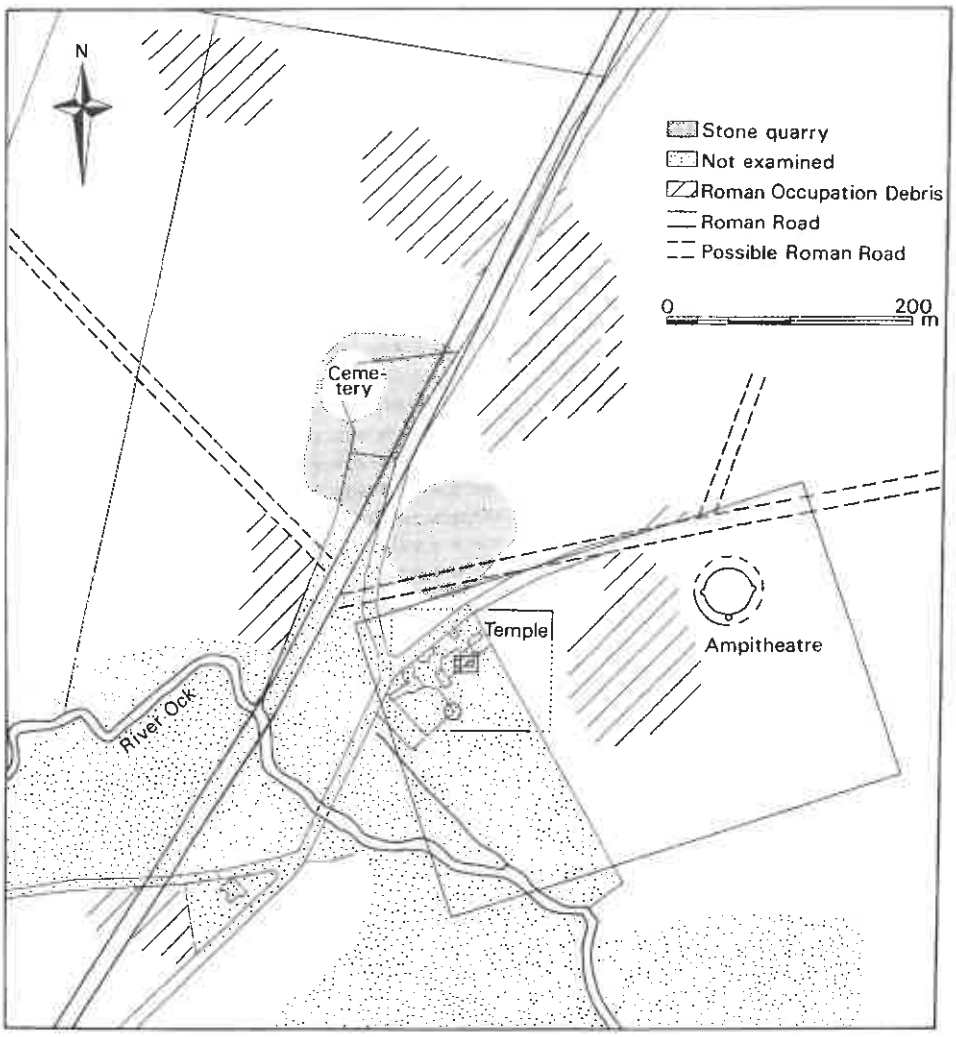


Figure 2: Noah's Ark site and the 'amphitheatre' in Trendles field (after Hingley 1985, fig. 3)

Current excavations at Marcham/Frilford started in 2001 under the direction of Gary Lock and Chris Gosden, of the University of Oxford. Work on site acts as a training excavation for Oxford University students and is also an opportunity to educate the public, who regularly visit under the guidance of the site's Education Officer (Lock *et al.* 2002, 69-70; 2003, 84). Using the results of Hingley's survey, as well as their own ongoing geophysical survey, the approach has been to target excavations on specific geophysical anomalies (*ibid.*). Figure 3 (see below) shows the location of some of the trenches opened since 2001 (for a complete plan of all the trenches and further details on excavations see Lock *et al.* 2003, page 85, and http://athens.arch.ox.ac.uk/~glock/fieldwork/ridgeway/index.htm).

Trenches 3 and 12 revealed more Iron Age pits, postholes and artefacts, extending the original settlement discovered in the 1930s (see above). The enclosure ditch cutting through both trenches consisted of two phases; it proved to be a Bronze Age ditch re-cut during the Roman period. Overall, the south-western area of Trendles field shows some Bronze Age features and a "high concentration of Iron Age activity." (Lock *et al.* 2003, 84; 2002, 76-9)

Trench 2 revealed a large Roman rectilinear building, nearly thirty-four metres long and seventeen meters wide, overlying Iron Age features. The building appears to have been built on "reddish-orange soil which is consistent with the 'Iron Age soil'" (Lock *et al.* 2003, 86). The complex stratigraphy showed that the original building had limestone walls and a wooden floor, which burnt down and was replaced with rubble, bone and tiles. Within the building, several late Roman coins were found, these "strongly suggest that both construction and re-use happened in the late to very late Romano-British period." (Lock and Gosden, in press.). The coins appear to have been lost "through trading activity, and/or possibly votive deposition" (*ibid.*). The authors argue that the monumental structure initially had a high-status ceremonial function; after the fire, however, the structure was downgraded to more utilitarian purposes, such as that of penning animals. (*ibid;* Lock *et al.* 2002, 73-6; 2003, 86-8)

Trench 1 aimed to investigate the entrance of the 'amphitheatre' located during the 2001 field surveys. This entrance is not the one noted by Hingley in 1978, which remains unexcavated (fig. 3). Part of the wall and bank were revealed, upon which no evidence for seating was found, though it is true that most of the bank has now been ploughed away. The bank, which is about fifteen metres wide, was built on top of the local soil with sandy loam, probably from within the arena, and discontinuous layers of sand and clay. The apex of the bank is missing, but it seems to have been gently rounded and not terribly high. The wall consists of well-dressed limestone blocks cemented together with mortar, upon which localised traces of red paint survive. The wall was built on bedrock, which today, is below the water-table. Trenches 1 and 9 lie on the transition from Fyfield to Sherborne soil series (M. Langford pers. comm.). The bedrock slopes towards the increasingly waterlogged arena centre, creating "a natural hollow, formalised by the building of the wall." (Lock and Gosden, in press). The entrance is defined by a gap in the wall and bank, where a step was built on top of rubble and "black water-lain clay, which looks like a ponding deposit laid down in still water." (*ibid.*). It appears that the wall may once have been continuous and then broken

through to accommodate a ramp, on top of which a step was later added. (*ibid;* Lock *et al.* 2002, 70; 2003, 88-9)

Trench 9 re-opened and extended Hingley's trench in which he had discovered the stone 'alcove' (see above) (plate 5). The southern wall and abutting rectangular structure within the bank were revealed at the southern end of Trench 9. "A long section was cut through the bank from the arena wall ... to the back end of the bank at the south" (Lock *et al.* 2003, 89) (fig. 8 - page x). (9142) contained small ceramic sherds, possibly Iron Age, and was described as a probable buried soil. The bank's stratigraphy suggests a smaller initial bank, followed by a larger bank which extended southwards. "Large numbers of objects were deposited at the southern end of this bank, at least into the fourth century AD." (Lock and Gosden, in press). The rectangular room "is composed of three walls with the arena walls forming a fourth side. The room is roughly 2.5m east-west and just over 4m north-south." (Lock *et al.* 2002, 73). Running north-south across the centre of this room a drain made of large flagstones was located. The drain cuts under both the arena wall and the southern wall of the rectangular room. "The downward slope of the feature, [and] the presence of water at the same level as the feature, would suggest that its ... function was to transport water away from the arena" (Lock and Gosden, in press). Inside the arena wall, and at about one metre from its surface, a well-packed gravel floor was discovered. Towards the centre of the arena and at a depth of approximately two metres, a human bone and oyster shells were found in association with a collection of stones. Near this assemblage, stood an intact waterlogged timber, from which a radiocarbon date was retrieved: 30 B.C. – A.D. 245 calibrated (early Romano-British period). Whether there is an underground spring fed by the possible palaeochannel seen on aerial photographs, or whether the water-table has always been high are questions currently being addressed by Mike Langford from the Department of Continuing Education, Oxford University, for his MSc dissertation. Current interpretations suggest that a natural coomb was enclosed, first by a bank and then a wall, to create a ritual pool; the rectangular room may have been used to regulate water-levels and/or quality. Excavations have revealed that the southern wall and bank were removed for the incorporation of a drain. The wall was then re-built, and a rectangular structure added above the drain. It is also possible that the drain and gravel floor were placed specifically to drain the 'pool', and therefore mark a change in the function of this large circular structure. (Gosden and Lock 2003, 157-9; Lock *et al.* 2002, 70, 73; 2003, 89; Lock and Gosden, in press)

Trench 18, close to the temenos wall, was opened where the geophysical survey showed structural remains, and where Hingley had found artefacts suggestive of domestic activities (Hingley 1985, 207; Lock *et al.* 2003, 88). The trench was divided into arbitrary sectors and excavated accordingly. From the start of the excavations "a rich assemblage of finds, including painted wall plaster, a range of ceramics, and ... well crafted metal artefacts" (Lock *et al.* 2003, 88) started to be recovered. Decorated Neolithic sherds were also found, extending the sequence of occupation further back in time. At present there seems to be two rectangular buildings, both aligned on an east-west axis. Neither of the buildings in Trench 18 appear to have had an eastern wall; the northern building has a cobbled surface that extends out from the main room (plate 7), where it may have been covered by a wooden portico, whilst the southern building has a gravel surface extending out (P. Daly pers. comm.). Together the finds suggest the building was in use from late first/early second century to late third/early fourth century.

> "It is possible that the structures in Trench 18 are part of a number of ancillary buildings built around the outside of the temple's temenos wall that existed to serve the needs of visitors to the temple... Many of the finds so far indicate feasting and food consumption including fine wear beakers and cups, samian bowls, flagons, handled glass vessels together with the bones of young pig, lamb, chicken, wild birds, calf or veal, and many oysters." (Lock and Gosden, in press)

There can be no doubt as to the function of Marcham/Frilford as a Romano-British religious complex of probable Iron Age origins. The use and significance of individual buildings, however, as well as the site's relationship to contemporaneous settlements, are questions, which as of yet, remain unanswered. Hingley (1985), during his field survey, detected several areas scattered with Roman occupation debris (fig. 2). One of these areas (Trench 18) turned out to be a series of commercial buildings (see above); current excavations have not detected any conclusive evidence for residential structures in Trendles field. The cemetery does not appear to have been used before the 4th century A.D., but then continued in use into the Anglo-Saxon period (Bradford and Goodchild 1939, 1, 69). Artefacts suggest the cemetery was at least contemporaneous with the public building in Trench 2, and without a settlement close by, one is forced to accept an association between the two. "The relationship between temples and cemeteries is a problem ... but there is evidence from one or two sites in Britain...: both at Lancing, Sussex, and Waltham St Lawrence, Berks., inhumations have been found in close proximity to Romano-Celtic temples." (*ibid.* 69). The nearest Romano-British town is Abingdon, four to five kilometres south-east of Marcham/Frilford (Lock *et al.*

2002, 82). The area is, nevertheless, littered in Roman villas, (Millett 1990, fig. 48), the nearest one being one and a half kilometres north-west of the temple (Hingley 1985, 201). Temples in rural isolation were not uncommon in Roman Britain and Gaul; "their position did not depend upon the residence nearby of large numbers of people." (Lewis 1966, 129; *cf.* Leday 1980 for some rural shrines in Gaul). The positioning of Marcham/Frilford along a junction of Roman roads (fig. 2), meant that the religious complex was bound to attract an important number of people even though it seems to have never been directly associated with a large settlement.

Current excavators of Marcham/Frilford relied, up until 2002, on artefacts and architectural remains to explore the significance of the site. Since 2003, however, micromorphology has been adopted as an integral approach to the excavation of the site. The analysis of undisturbed samples, representing the accumulation of occupation debris through time, and/or the stratigraphy of soils whose development is inextricably linked to specific past and present anthropogenic behaviour, has a vast potential in identifying and explaining minute traces of past activities, otherwise undetectable in the field. At a time when the interpretation of individual structures, namely those in Trench 18 and the 'ritual pool', are beginning to take shape, the analysis of micromorphology samples taken in 2003 provide an unexpected wealth of information for better understanding the buildings and, consequently, evaluating Marcham/Frilford in its wider Roman landscape.

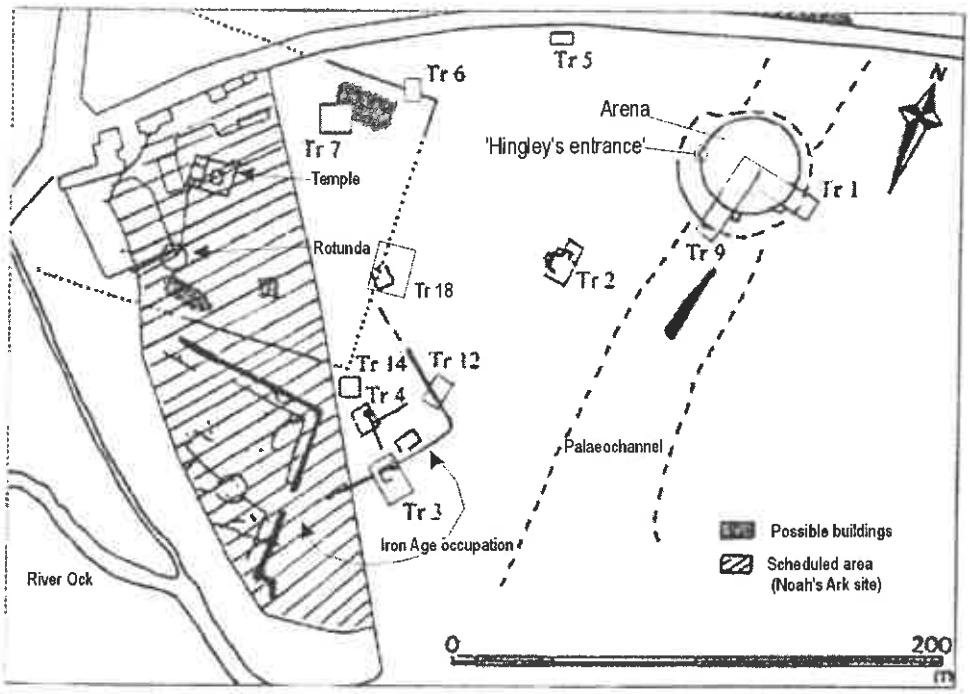


Figure 3: features seen on aerial photographs and location of trenches from current excavations (adapted from Gosden and Lock 2003, 156)



Plate 1: west facing photograph of the wall attaching the rectangular structure on the left to the 'ritual pool'. The drain can be seen to run under the wall from within the arena and into the rectangular structure, where it lies beneath the flag-stones.



Plate 3: the drain running north-south across the rectangular room.



Plate 2: south-west facing photograph of the arena wall curving round, and the (just visble) western wall of the rectangular structure.



Plate 4: west facing photograph of the entrance to the 'ritual pool'. The bedrock slopes heavily to a step (under the green plastic). The arena wall can be seen abutting on to the step.



Plate 5: south facing photograph of Trench 9 with the rectangular structure. The excavated square at the bottom of the photograph is the geometrical centre of the 'ritual pool', where the water-logged wooden post was retrieved.



Plate 6: east facing photograph of Trench 1 from the water-logged geometrical centre. The entrance to the 'ritual pool' can be seen in the top right-hand corner, where the step is covered in green plastic. The arena wall continues from the step.



Plate 7: west facing photograph of the cobbled entrance to the northern building in trench 18. Sector 13 lies behind the excavators, near the edge of the trench.

Note: All the photographs, including those in the following chapter, were taken by the author on the 12th July 2004

SAMPLING FOR MICROMORPHOLOGY

In the summer of 2003, Dr. Helen Lewis of the Department of Continuing Education at the University of Oxford took ten block samples for micromorphological analysis from Marcham/Frilford, Trendles field. All thin-sections are 7x5cm, except for sample 9.25 which is 13.5x6.5cm. Contexts were described in the field and can be found in table 1 (see below). This July I spent two days on site with Dr. Lewis, obtaining and re-drawing plans and sections (presented below[1]), taking photographs and talking to site supervisors. These two days have proved invaluable for gaining a better understanding of the site, from individual sections to the natural surroundings.

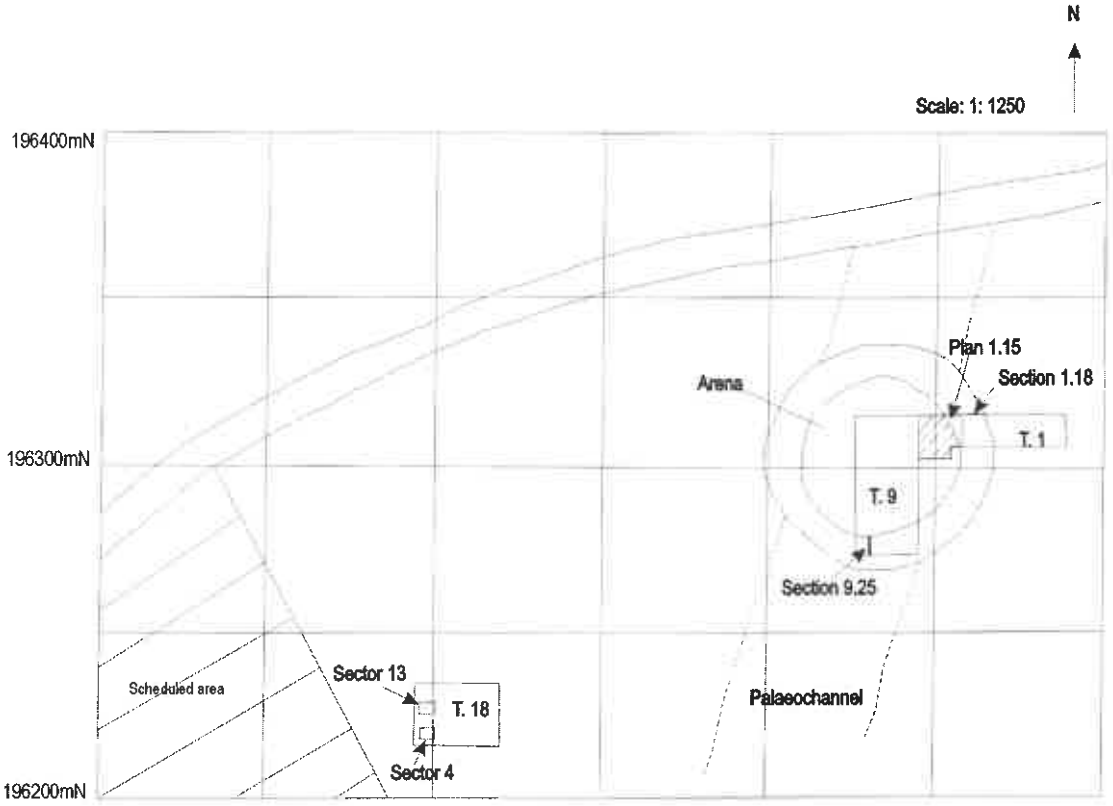


Figure 4: the position of trenches targeted for micromorphology

The samples taken are representative of the pre-Roman site soil profile, the Romano-British bank and of some structural features. Of these, five samples were retrieved from Trench 1 (figures 5 - 7). Sample 1.12 was taken from section 1.23, inside the arena wall, just south of the entrance (fig. 5). The plan corresponding to section 1.23 was not available, so plan 1.15 is portrayed here. The latter depicts a layer above the one from which section 1.23 was dug, where the surface of the wall slightly spreads out

[1] The diamonds on the section drawings represent the location of micromorphological samples, not their actual size.

laterally (which is why the section appears to extend into the wall). The purpose of sample 1.12 was to investigate the nature of the arena floor, and the relationship of the 'ritual pool' to the palaeochannel. Samples 1.3 – 1.5 come from the palaeosol beneath the Roman bank, whilst sample 1.16 is from within the bank (fig. 7). These samples were taken to explore the longer-term history and continuity of the site, and analyse the buried soil for any signs of pre-Roman land use. As can be seen in figure 7, the turf line of the buried soil was still clearly visible in the field indicating a good preservation of the original soil profile.

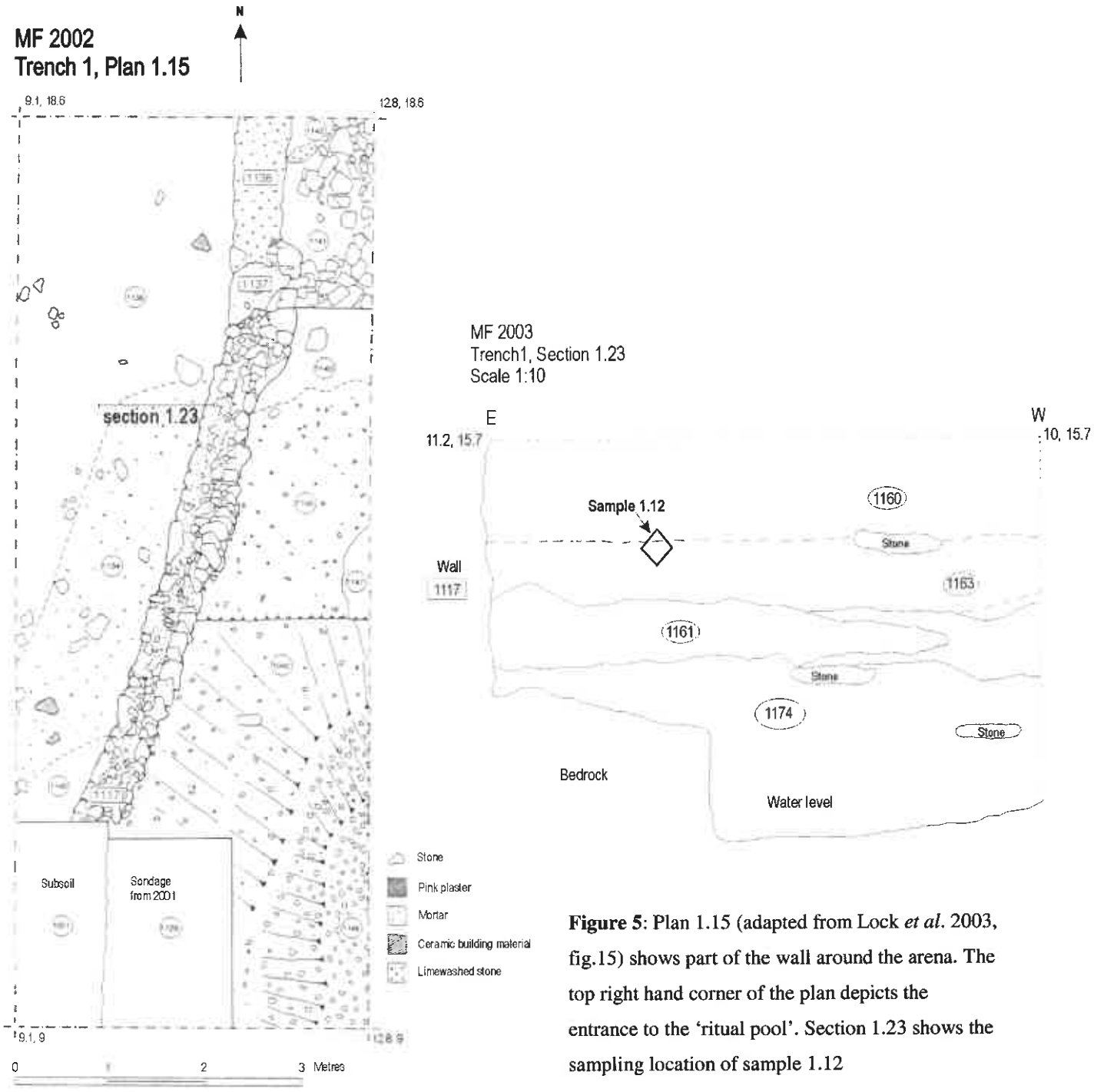


Figure 5: Plan 1.15 (adapted from Lock *et al.* 2003, fig.15) shows part of the wall around the arena. The top right hand corner of the plan depicts the entrance to the 'ritual pool'. Section 1.23 shows the sampling location of sample 1.12

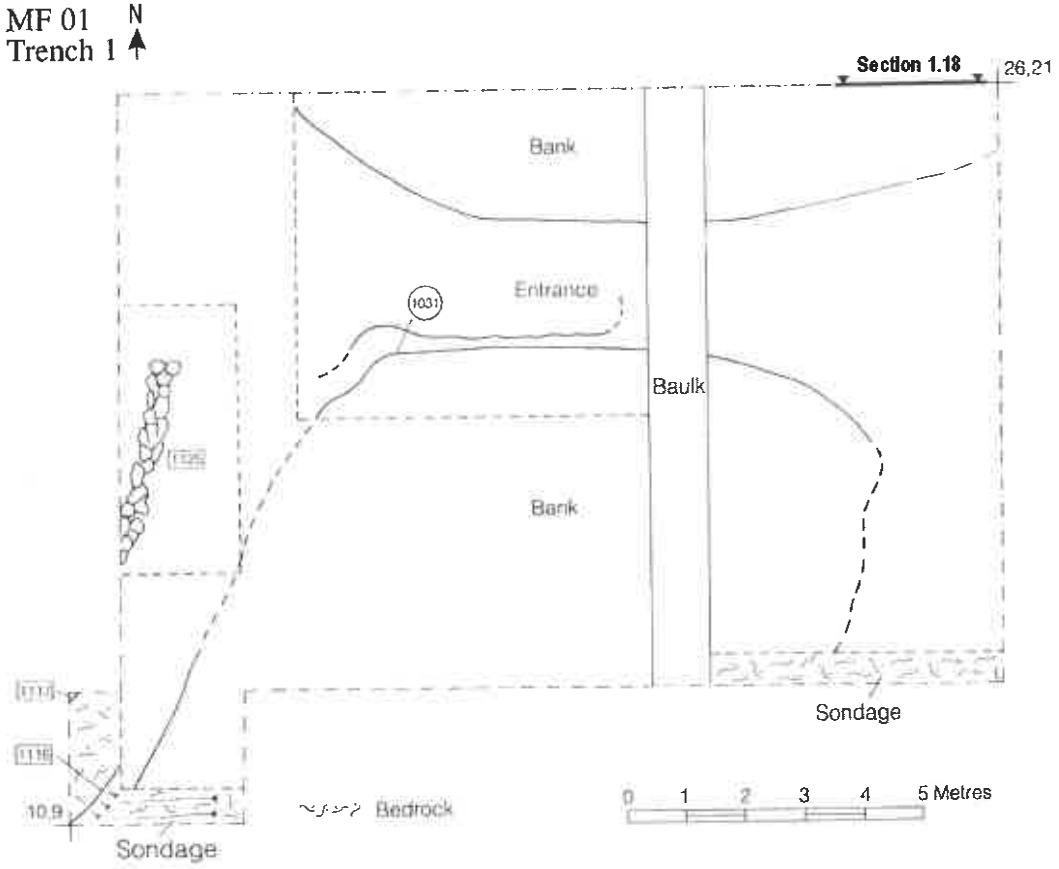


Figure 6: A schematic plan of the 'ritual pool's' eastern entrance, (adapted from Lock *et al.* 2002, fig.15)

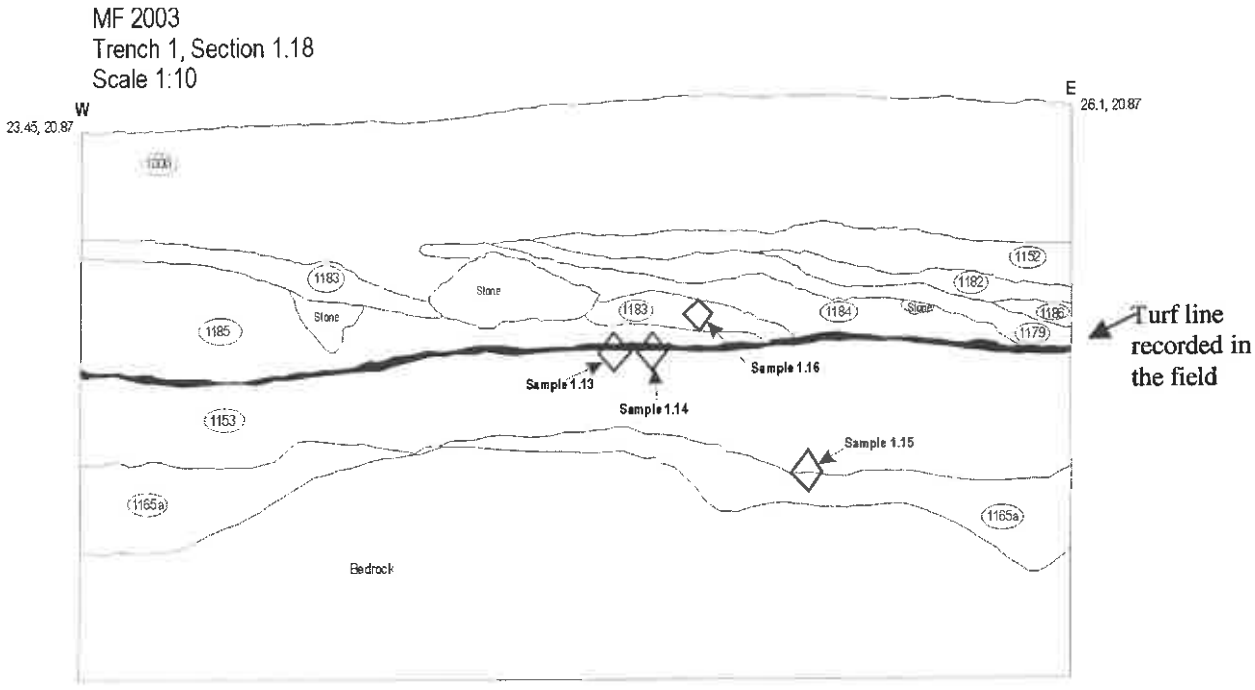


Figure 7: South facing section. Sampling locations of 1.16 within the Roman bank, and 1.13-1.15 in the palaeosol

Sample 9.25 was retrieved from section 9.25, Trench 9 (figures 4 and 8). The section extends from the exterior of the most southern wall of the rectangular room, and cuts through the Roman bank, just above, parallel and slightly to the west of the drain. Unfortunately, no plan of the area was available (but see fig. 4 above). Sample 9.25 incorporates three contexts from the bank and should provide a good description of construction materials. During sampling (one year after the section had been opened) only two contexts were noted. The third one (9058), however, is clearly visible in thin-section. It is hoped this sample will shed some light on the relationship of the 'ritual pool' with the palaeochannel.

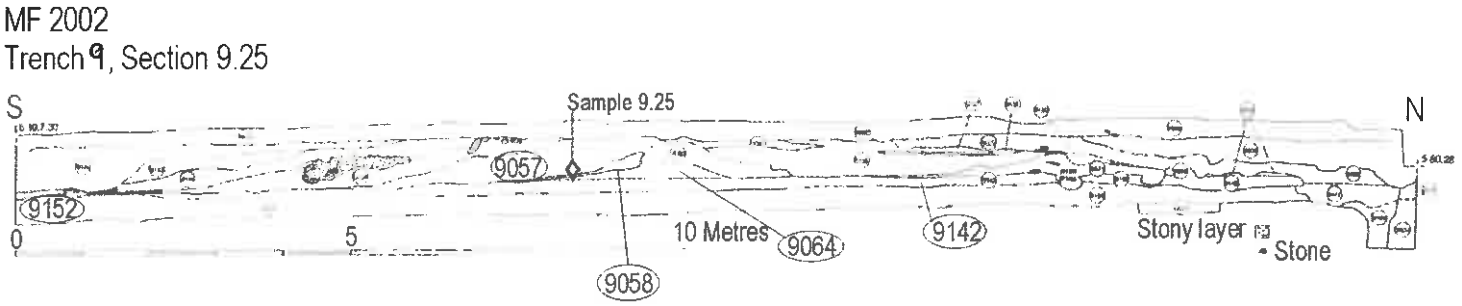


Figure 8: East facing section. Sampling location of sample 9.25 (adapted from Lock *et al.* 2003, fig.17), (see fig. 4 -above- for the position of this section)



Plate 8: north facing photograph of sections through the bank behind the rectangular structure. Section 9.25 (which was not opened this year) must have looked very similar to those visible here

Both sectors 4 and 13 were targeted from Trench 18 (fig. 4). Samples 18.11 and 18.12 were taken from section 18.13, sector 13 (fig. 9). Notice that context (18050) in plan 18.64 corresponds to (18050) in section 18.13; this plan was drawn two years after the section was recorded. These samples were retrieved to analyse the nature of the visible floors and 'burnt' deposit.

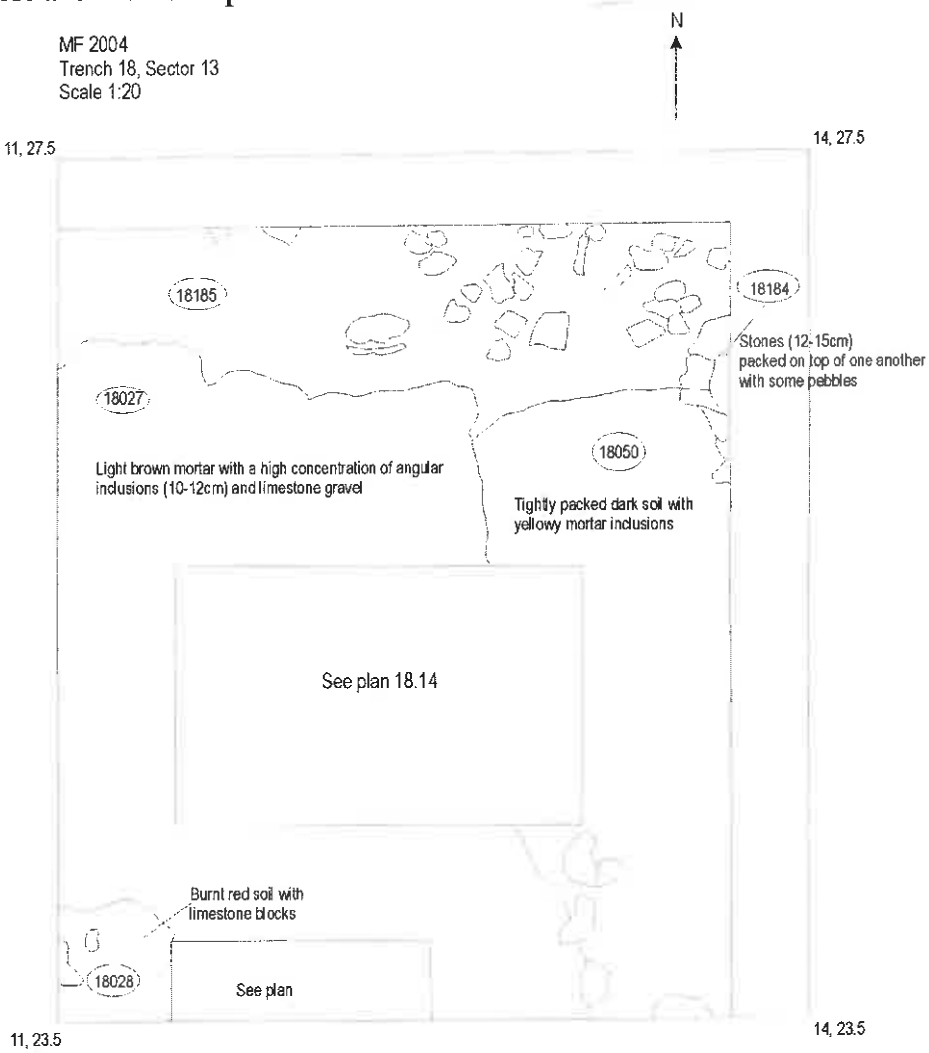


Figure 9: Schematic plan of sector 13 (above) and plan 18.14, showing the position of section 18.13

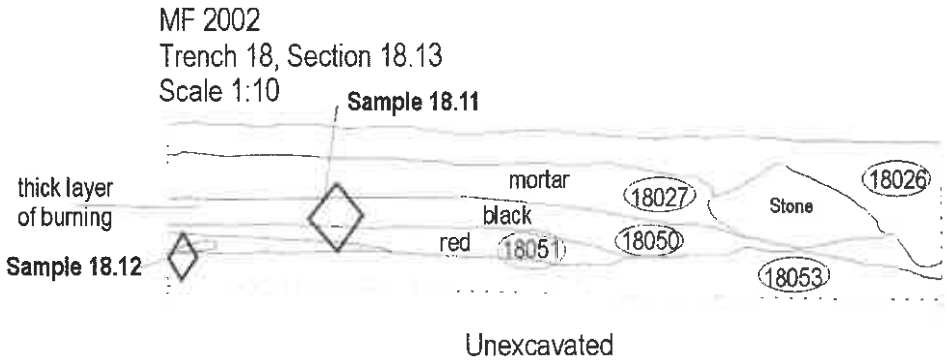


Figure 10: Section 18.13 showing the sampling locations of samples 18.11 and 18.12

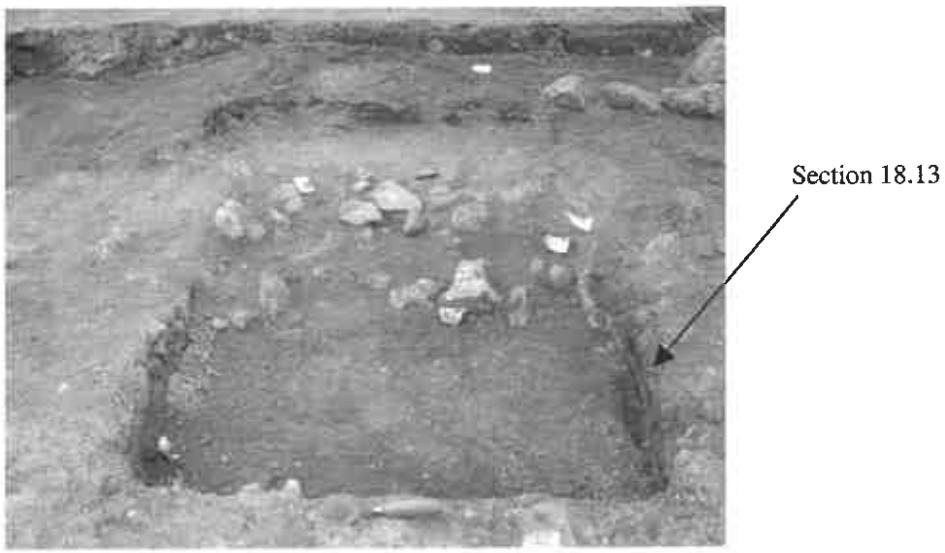


Plate 9: east facing photograph of sector 13. The black layer, context (18050), is still visible at the top of the photograph

Samples 18.09 and 18.10, from section 18.15, come from the eastern edge of sector 4 (fig. 11); the latter lies seven meters south of sector 13 and is part of the same building complex. It is hoped the samples will help to produce a better understanding of the purpose, use and histories of the Roman buildings under excavation.

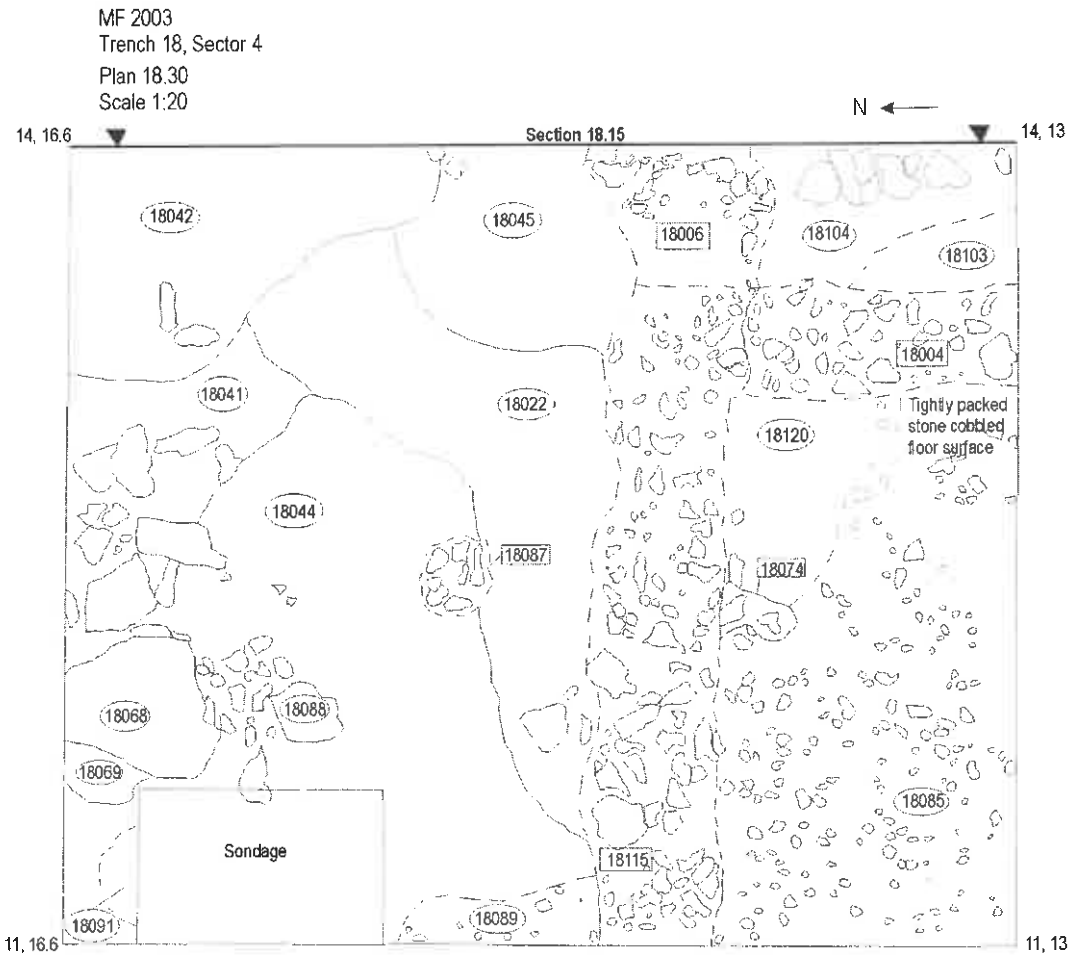


Figure 11: Plan of sector 4, with the location of section 18.15

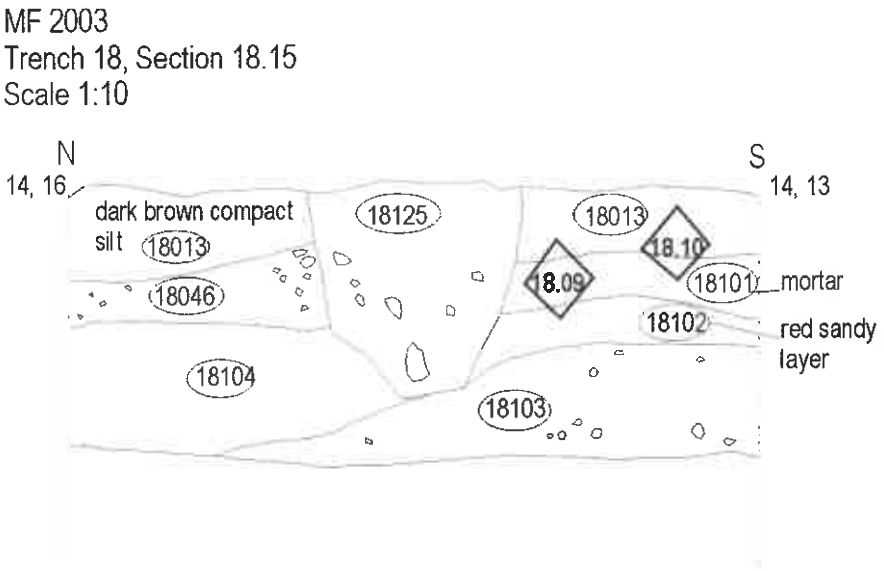


Figure 12: Section 18.15 with the location of samples 18.09 and 18.10



Plate 10: east facing photograph of sector 4

The samples were taken to the McBurney Geoarchaeology Laboratory, Department of Archaeology, University of Cambridge. They were air-dried, impregnated with a crystic polyester resin and thin sectioned according to Murphy (1986) by Julie Miller. I analysed the ten sections using a binocular microscope with a magnification of X10 to X25, under plain polarized light (PPL), crossed polarized light (XPL), and reflected light. The samples were described according to Bullock *et al.* (1985) and Stoops (2000). Percentages and ratios are visual estimates. A full technical description can be found in the appendix, whilst the following chapter presents a more

digestible version illustrated with scanned images and photographs of the samples. The results are explained and discussed in chapter 5.

Table 1: Field Descriptions of Contexts

	Sample Number	Context Number	Field Description
Trench 1 Section 1.18	1.16	(1184)	Compact, mid yellowish-brown sandy clay. Bank material.
		(1183)	Compact, mid grey, gritty sandy loam.
	1.16, 1.13 and 1.14	(1185)	Same as (1184)
	1.13, 1.14 and 1.15	(1153)	Friable, mid reddish-brown sandy loam.
	1.15	(1165a)	Natural clay above bedrock.
Section 1.23	1.12	(1160)	Compact, reddish-brown sandy loam with manganese flecks
		(1163)	Loose to compact, greyish, gritty sandy loam with charcoal flecks.
Trench 9 Section 9.25	9.25	(9057)	Loose to friable, sandy, yellow-greyish-brown. Concentration of iron flecking above (9058)
		(9058)	Friable, mid yellowish-brown, sandy with clay patches.
		(9064)	Friable, mid grey-brown sand with occasional flecks of charcoal and tile; still bank material.
Trench 18 Section 18.15	18.10 and 18.09	(18013)	Dark brown compact silt.
	18.10 and 18.09	(18101)	Compact white mortar of fine sandy silt with gravel inclusions.
	18.09	(18102)	Friable, mid reddish-brown silty clay.
Section 18.13	18.11	(18027)	Compact, light yellowish sandy mortar with gravel.
		(18050)	Black layer of burning with yellow mortar inclusions. It extends over most of the building.
		(18051)	Compact red loam, from burning
	18.12	(18052)	Dark brown burnt loam.
		(18053)	-No description available-

RESULTS

TRENCH 1

Samples 1.13 – 1.15 depict the Iron Age palaeosol underneath the Roman bank: loamy sand developed on oolitic limestone, whilst sample 1.16 is from within the bank, above the previous samples (fig. 7, plates 11-13). The well to moderately sorted soil has a high coarse component (35-40%), made up predominantly of quartz with some weathered limestone fragments. Porosity is high (35-40%), and reflects the natural sandy soil as well as disturbance by microfauna. The fine material (15-20%) appears granular and is composed predominantly of very fine quartz sand, micrite and microsparite calcium carbonate. The overall sand:silt:clay ratio is 10:1:2. The fine groundmass tends to be distributed around sand grains, effectively cementing them together, and is heavily impregnated with iron oxides present in the clay fraction, amorphous sesquioxides and iron nodules. The concentration of iron makes it difficult to detect organic matter, so that there may be more than the small amounts noted during analysis (see table 2 and the appendix). The dense distribution of micrite and microsparite result in a microcrystalitic b-fabric of the fine groundmass. These small (<50μm) crystals of $CaCO_3$ (Bullock *et al.* 1985: 120) derive from the weathering of the limestone parent material and/or their presence in the groundwater solution.

At the bottom of sample 1.15 is a layer of clay, *c.* 8mm thick, moderately rich in manganese and mixed with *c.* 30% loamy sand. The orangey clay, of moderate birefringence is the same as that seen in sample 1.13 - the only other sample where aggregates of clay are visible. The microstructure, with a porosity of 20-25%, is by no means massive. Above this layer of clay is a section of loamy sand in which no clay coatings or aggregates are visible.

About 20cm above sample 1.15, and slightly to the left, lie samples 1.13 and 1.14 (fig. 7). Although these two samples were taken from the same stratigraphic level, they do differ, namely in iron and clay distribution. Sample 1.13, like the other sections of loamy sand, is reddish-brown (XPL) from iron-rich clay. Dirty clay coatings are present, though the majority of coatings and hypocoatings consist of groundmass material. What clearly differentiates sample 1.13 from the other loamy sand samples however, is the presence of orangey-gold (XPL) clay aggregates with a low

concentration of manganese, showing a striated orientation and a moderate degree of birefringence (plate 11b). Also visible are hints of thin pure clay coatings, followed by dusty, then dirty clay coatings around very few sand grains (plate 11a). These clay pedofeatures occur in the lower half of the sample and are clearly a result of the illuviation of clay down profile, since clay coatings are absent from the loamy sand in sample 1.15. Both samples 1.13 and 1.14 have few charcoal fragments, evenly distributed throughout.

The distinct black layer seen in the field is not evident in samples 1.13 and 1.14 (fig. 7), though they are rich in ferro-manganiferous nodules (plate 11c). 1.13 has three plant organs, of moderate birefringence and at least partially impregnated in iron. It is more heavily bioturbated than 1.14, the latter appearing redder because of its higher proportion of fine groundmass. Consequently, it is difficult to see whether aggregates of orangey-gold clay are present in 1.14. Thin coatings of yellow silty clay are just visible around grains, pores and aggregates of fine groundmass. The iron, as is visible by its colour, is clearly in its ferric sate, i.e. oxidised.

Sample 1.16, taken from within the Roman bank above the previous samples (fig. 7, plate 13), could represent the lower A and upper B horizons of the Iron Age land surface. It contains slightly more organic matter than the other soil samples, and is also a little less compact. The fabric is very heterogeneous, showing no orientation of particles or organised distributions. These characteristics, however, could result from bank construction and later pedological processes within the bank. It is logical to assume that the other soil samples are more compact due to bank overburden, and contain less organic remains simply because plants have not grown on that surface since the Roman bank was built. Ferric iron, present in all the samples, indicates a well aerated environment which is not conducive to the preservation of organic remains (Evans and O'Connor 1999: 80-2). This sample demonstrates that the bank was constructed with locally derived soil.

Sample 1.12 is a section through loose, completely unoriented loamy sand, from within the 'ritual pool'. The soil appears to have been heavily mixed and/or dumped, either intentionally or from the destruction of the Roman wall and bank. There are two bands rich in oxidised iron and manganese aggregates witch do show some orientation, cutting across the slide from top right to bottom left at an angle of *c.* 225° clockwise

(plate 14). The uppermost band or layer, is not only mixed with loamy sand but also contains a few limestone fine gravel pebbles (<1cm across) and localised patches of what could be ash, overlain by sand grains and shell fragments. The 'ash' is made up of fine, medium to dark grey crystals of $CaCO_3$ (< 30μm), with low birefringence (XPL) (plate 14a). Within both bands, a piece of corroded copper (*c.* 500μm in size) was noted. Two pieces of corroded copper (250μm and 350μm in size) were also seen between the two layers of iron and manganese.

TRENCH 9

A single sample with four fabrics was analysed from trench 9, from a section just above and parallel to the Roman drain (fig. 8). The top half of the slide (fabric **a**) is composed of the same loamy sand described above, including a high quantity of ferro-manganiferous nodules. Two pieces of corroded copper (both 100μm in size) were counted (plate 18a). The boundary between this fabric and the next is defined by a clear, straight line.

Half way down the slide, and only 3mm thick, is a layer of oxidised iron and manganese (fabric **b**). The two minerals occur as small, individual nodules and coatings around sand grains (plate 15a). The layer is too thin to be a distinct iron pan. Its boundary with the lower fabric is also defined by a clear, straight line.

The next 4cm of this slide contain the same loamy sand seen above except that there is a marked reduction in iron oxides, a decrease in sand grains (20-25%) and an increase in clay (15-20%) (fabric **c**). Only 10-15% of the groundmass contains iron oxides, mainly in the form of sesquioxides as well as a few nodules. The weekly reticulated golden-brown (XPL) clay appears mostly as unaccommodated aggregates with few dusty coatings around pores and grains (plate 15b). Two pieces of corroded copper (50μm and 100μm in size) were noticed.

The remainder 2cm are composed of the natural loamy sand (fabric **d**). It is clear from this thin-section that at least two different locally derived soils were used during the construction of the Roman bank: oxidised loamy sand from fabrics **a** and **d** (also seen in sample 1.16), and a seasonally water-logged soil represented in fabric **c**.

TRENCH 18

Sample 18.09, from within a Roman building in sector 4 (fig. 11, plate 16), is made up of three fabrics, two of which are very similar and composed of loamy sand. The main differences between these two layers is the presence of eleven pieces of corroded copper (<50-250μm in size) in the upper layer, and the less compact, more disturbed nature of the lower layer. Otherwise, these fabrics represent the same loamy sand described above.

The third layer, *c.* 1cm thick, occurs roughly two-thirds down the slide. It is composed of bioclasts, medium to fine quartz, a few larger pieces of oolitic limestone and possibly ash (the same grey crystals described in 1.12) (plate 16a). The grains are loosely packed together, having been disturbed after deposition. There are two grains of oolite, both 1.5cm across, lying just below this layer and almost parallel to it. Four pieces of corroded copper (100-300μm in size) were counted. This layer's boundary with the lower soil is diffuse, and the two fabrics have evidently been mixed. Its boundary with the upper soil is neater and almost straight.

Sample 18.10, which overlies 18.09, consists of a single fabric: the same sandy loam described in Trench 1; it is not dark brown compact silt as described in the field (table 1) (plate 17). Twelve pieces of corroded copper (50-400μm in size) were counted.

Sample 18.11, from within a Roman building (figures 9 and 10), can be separated into three distinct fabrics: **a**, **b** and **c** (plate 18). Layer **a** is *c.* 2cm thick, and is composed of loosely packed large sand grains of rounded limestone and subangular quartz (3000-100μm size range), within a sparse groundmass of loamy sand. Patches of fine grey crystals make up 2-5% of the groundmass; they could be ash. Almost all of the sand grains are coated with fine groundmass material and clay. The fabric is poorly sorted, with quite a high porosity (25-30%). It appears white or light grey when seen by the naked eye. Five pieces of corroded copper (100-400μm in size) were noted. Its boundary with layer **b** is defined by a very straight line, clearly visible in PPL as a demarcation in colour (**b** being darker brown than **a**). The line of colour cuts through pores and sand grains.

Layer **b** is a section of loamy sand, *c.* 3cm thick, very rich in organic matter and charcoal. This layer is relatively more compact, with a porosity of 15-20%. Amorphous organic matter and charcoal fragments, especially those close to layer **a**, are horizontally

oriented. Seven faecal spherulites were counted, all in voids. The fabric, like the other samples of loamy sand, is well to moderately sorted and reddish-brown (XPL). While a lot of the sand grains have coatings of fine groundmass material, no clay coatings were seen. At about 0.5cm up from fabric **c**, there is a zone of irregular aggregates (200-1500μm) with diffuse boundaries of densely packed micrite. These aggregates have accumulated horizontally to form an incipient crust of $CaCO_3$ (plate 18b). At the bottom right-hand corner of layer **b**, and lying parallel to layer **c**, is a fragment of corroded copper, *c.* 7mm long and 1cm wide (plate 18c). Five smaller pieces of corroded copper (50-250μm in size) were also noticed throughout the groundmass. The boundary with layer **c** is irregular. The two fabrics have been slightly inter-mixed, obscuring the transition.

Layer **c** is evidently of anthropogenic origin. It is composed of 20-25% ash mixed with limestone and quartz (plate 18d). The larger sand grains have a vague horizontal orientation. Few clusters of faecal spherulites are also present. The fabric is compact; cracks are present, running vertically from the surface of the layer. Moving down this layer, an increase in iron oxides is visible, until one reaches the last half centimetre of underlying soil which is heavily impregnated in iron. **c** gradually mixes into the soil, forming a diffuse boundary. Charcoal and amorphous organic matter within the soil, just below **c**, are horizontally oriented.

Sample 18.12 was taken just below and slightly to the right of sample 18.11 (fig. 10). The top half of the slide shows a section through a piece of limestone (visible in the section drawing - fig. 10), whilst the lower half is composed of loamy sand, compacted by the overlying sediments (plate 19).

Table 2: Summary of Thin Section Descriptions, Trench 1

			Organic and Mineral Components									Most Common Pedofeatures						
Slide **Fabric**	**Fabric**	**Porosity**	Organic punctuations <50μm	Amorphous organic matter (brown)	Charcoal	Ash	Faecal spherulites	Mollusc shell fragments	Egg shell fragments	Bone	Earthworm excretions	Impregnation of groundmass with iron oxides	Sesquioxides	Iron nodules	Ferro-manganiferous nodules	Coatings and hypocoatings of fine groundmass material on sand grains	Argillans around pores, grains and aggregates	**Pieces of corroded copper**
1.16 (1185)	Loamy sand: 35-40% coarse minerals, 100-1000μm with mostly medium to fine sand, subangular, unoriented, well to moderately sorted. 15-20% fine material: sand, micrite, microsparite, silt and clay rich in iron	35-40%	F	vF	F			vF				vD	Fr	F	Fr	vD	C	0
1.13 (1185)	The same loamy sand described above, with an increase in $CaCO_3$ and porosity, indicating bioturbation. Small aggregates of dusty, orangey-gold clay, occur at the bottom of the slide	40-45%	F	vF	F			vF				vD	Fr	F	Fr	vD	Fr	0
1.14 (1185)/ (1153)	The same loamy sand is visible in the top 1/3 of the slide. Below, the groundmass turns deep red, completely coated in iron	30-35%	F		vF							vD	D	C	Fr	vD	C	0
1.15 **a**	The same sandy loam seen in slide 1.16. Its boundary with **b** is clear, distinct	35-40%	F	vF				vF				vD	D	F		vD		0
1.15 **b**	A layer, *c.* 8mm wide, of orangey- gold clay mixed with 30% loamy sand.	20-25%	F									F	vF		F	Fr	D	0
1.12 **a**	Loosely dumped loamy sand, poorly sorted, unoriented.	30-35%	C	vF	vF			1		1	1	C	Fr	F		vD		2
1.12 **b**	Two layers, crossing the slide at 225° from the right, of iron and manganese oxide nodules mixed into fabric **a**, ash and limestone.	30-35%	C	vF	vF	F						Fr	Fr	F	Fr	D		2

Key: vD – very dominant (>70%); D – dominant (50-70%); Fr – frequent (30-50%); C – common (15-30%); F – few (5-15%); vF – very few (<5%) (based on Stoops 2003: 49).
I – indeterminate, mostly due to the masking effect of iron oxide.
All percentages are based on visual estimates of areas.
(Continued on p.28)

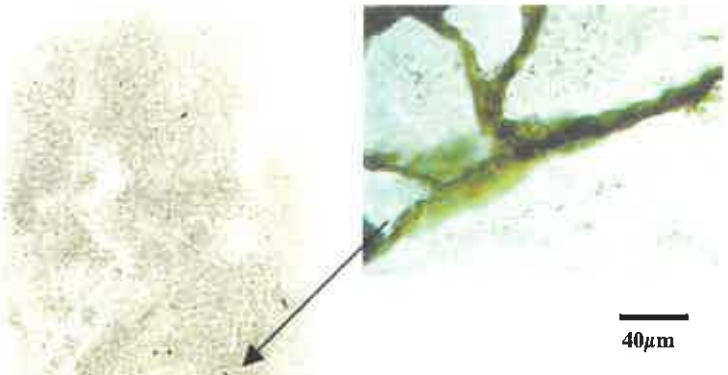
Trench 9 and 18

			Organic and Mineral Components									Most Common Pedofeatures						
Slide **Fabric**	**Fabric**	**Porosity**	Organic punctuations <50μm	Amorphous organic matter (brown)	Charcoal	Ash	Faecal spherulites	Mollusc shell fragments	Egg shell fragments	Bone	Earthworm excretions	Impregnation of groundmass with iron oxides	Sesquioxides	Iron nodules	Ferro-manganiferous nodules	Coatings and hypocoatings of fine groundmass material on sand grains	Clay coatings around pores, grains and aggregates	**Pieces of corroded copper**
T.9 9.25 **a** and **d**	A layer of the same loamy sand from slide 1.16. It is also present at the bottom of the slide for *c.* 2cm. Boundary with **b** is clear, distinct	35-40%	F	vF				1				vD	Fr	Fr	D	vD	C	2 (in **a**)
9.25 **b**	A layer of deep red iron and manganese impregnated groundmass, too granular and thin to be an iron pan. Its boundary with **c** is clear, prominent	35-40%	F									vD	F		D	C		0
9.25 **c**	Similar to **a**, except that the clay appears cleaner and less impregnated with iron. Boundary with **d** is diffuse and undulates	35-40%	F									C	F	F		Fr	Fr	2
T. 18 18.09 **a**	A layer of loamy sand, practically the same as that seen in sample 1.16, but with less iron and manganese. Boundary with **b** is clear, and almost horizontal	35-40%	F	C	F			vF		vF		F	F	vF		vD		11
18.09 **b**	A layer, *c.* 1cm thick, of limestone and ash without soil. It has a crumby microstructure. Boundary with **c** is clear but irregular	35-40%	F		vF	F							F					4
18.09 **c**	Loamy sand, as seen in **a** above, only more disturbed by microfauna	20-25%	F		F						1 or 2	Fr	Fr	F		vD	Fr	0

(Continued on p.29)

Trench 18

Slide Fabric	Fabric	Porosity	Organic and Mineral Components: Organic punctuations <50μm	Amorphous organic matter (brown)	Charcoal	Ash	Faecal spherulites	Mollusc shell fragments	Egg shell fragments	Bone	Earthworm excretions	Most Common Pedofeatures: Impregnation of groundmass with iron oxides	Sesquioxides	Iron nodules	Ferro-manganiferous nodules	Coatings and hypocoatings of fine groundmass material on sand grains	Clay coatings around pores, grains and aggregates	Pieces of corroded copper
18.10 **a**	This slide consists of only one fabric: the same loamy sand seen in trench 1.	35-40%	F	vF	F			vF				vD	Fr	F	vF	vD	Fr	10
18.11 **a**	A layer of large sand grains (3000-100μm), loosely packed together, with possible ash. Boundary with **b** is clear, distinct	25-30%	Fr	Fr	Fr	vF						vD	Fr	F	vF	vD	F	5
18.11 **b**	A layer of loamy sand, *c.* 3cm thick, compact and richly mixed with charcoal and organic matter, which show a horizontal orientation. It contains traces of a copper artefact and evidence for regular wetting. Boundary with **c** is diffuse, faint.	15-20%	Fr	Fr	D		7		Vf			D	F	vF		vD		6
18.11 **c**	A compact layer of ash and limestone, with increased iron oxides towards the bottom. Charcoal fragments are horizontally oriented	15-20% vertical cracks	C	F	Fr	vD	C					F	F	vF				0
18.12 **a**	A large piece of limestone occupies almost the entire top half of this slide. The remainder is composed of the same loamy sand described in trench 1. Compared to (1185), this sample of soil is slightly more compact	20-25%	F	vF				vF				vD	Fr	F	F	vD	Fr	0

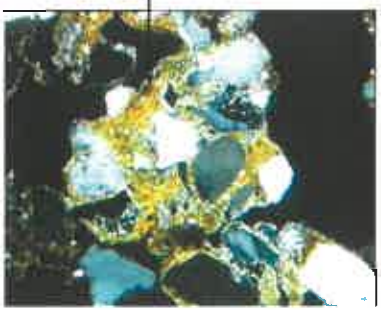


a) clay coatings becoming progressively dirtier (XPL)

40μm



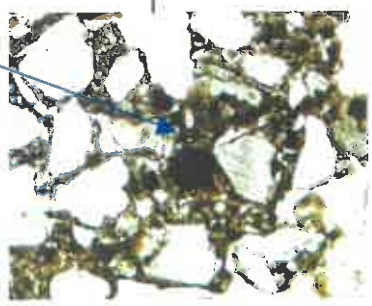
Plate 11: slide 1.13 on the left and 1.14 on the right. 1.14 has been noticeably less disrupted by microfauna. The only signs of a turf line are the ferro-manganiferous nodules.



b) orangey-gold clay aggregates (XPL)

250μm

c) ferro-manganiferous nodules in the fine groundmass (PPL)



250μm



Plate 12: slide 1.15. The layer of clay lying above the bedrock is clearly visible

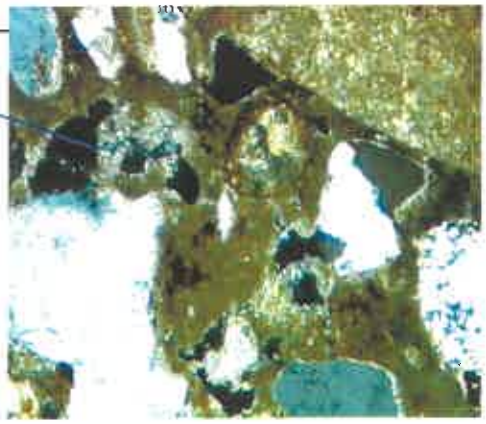
Plate 13: slide 1.16, taken from within the Roman bank. The groundmass is visibly the same as in the above slides (namely context (1185))





Plate 14: slide 1.12. The two bands of iron and manganese nodules are separated by a channel. They have clearly been disturbed since their formation. The larger sand grains a the top of the slide represent the original gravel floor surface

'ash'



250μm

a) grey 'ash' and gravel from the original floor surface is covered in amorphous organic matter and iron staining (XPL)

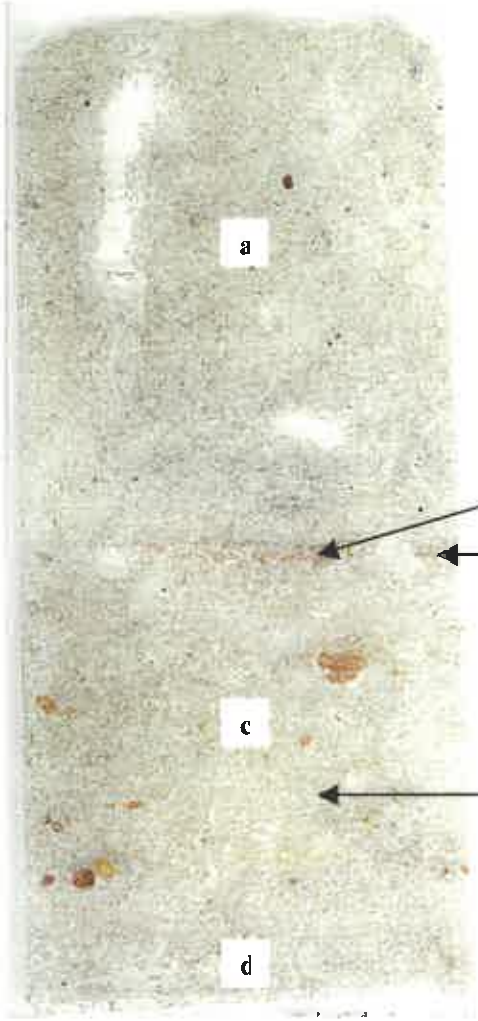
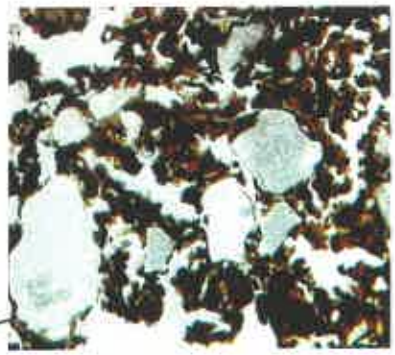


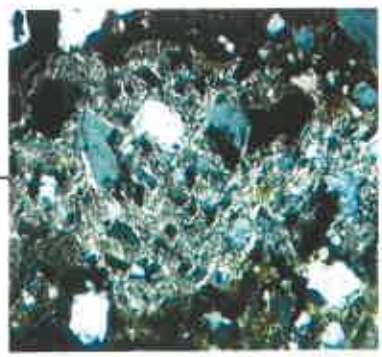
Plate 14: slide 9.25. The four fabrics are just visible to the naked eye: **a**; **b** the iron 'pan'; **c** rich in golden-brown clay, and **d** covering the last 2cm of the slide



250μm

a) coatings and aggregates of iron and manganese forming an incipient pan (PPL)

b) clay aggregate in fabric **c** (XPL)

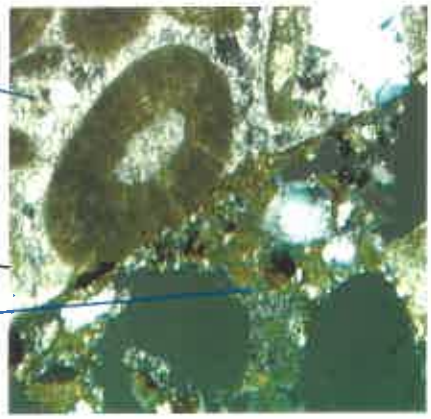


250μm



Plate 16: slide 18.09. The mortar floor is just visible half way down the slide. It is visibly disrupted by a channel.

Two large oolite sand grains have moved down profile through

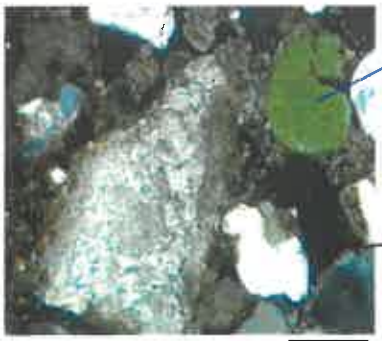


a) the mortar floor was made up of oolite gravel and 'ash' (see text for description) (XPL).

250 μm



Plate 17: slide 18.10. This slide is composed of loamy sand, not very different to context (1185). It was taken from above slide 18.09, but did not capture any of the mortar floor



A piece of corroded copper

a) fabric **a** is made up of gravel, 'ash' and soil (XPL)

250μm



a

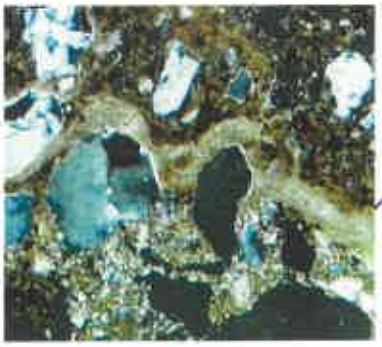
b

c



c) a fragment of corroded cooper lying on the ash floor (XPL)

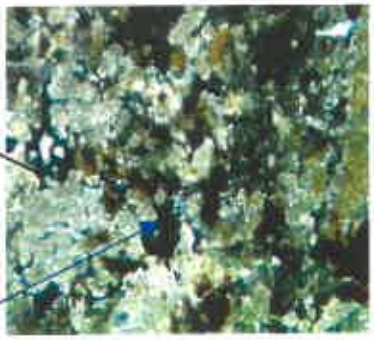
500μm



b) the layer of densely packed micrite can be seen undulating across the photograph (XPL)

250μm

Plate 18: slide 18.11. The three floor surfaces (**a**, **b** and **c**) are clearly visible



A faecal spherulite

d) ash crystals from the ash floor, stained by iron and amorphous organic matter (XPL)

100μm



oolitic limestone

natural loamy sand

Plate 19: slide 18.12, taken from below and to the left of slide 18.11

DISCUSSION

Before discussing each thin section individually, it is important to be aware of the soil conditions and understand the major pedological processes present.

Limestone, a sedimentary rock, is formed from deposits of dissolved material, mostly from sea water (Holmes 1978: 82-3). Oolitic limestone is composed of rounded grains of bioclasts, their shape resulting from the continual rolling on the sea bed as tiny grains of $CaCO_3$, such as microscopic shells, are gradually coated in successive layers of precipitated $CaCO_3$ crystals (*ibid.*). The oolitic deposits around Frilford are of Jurassic lithology and extend from Middlesbrough in the north to the south coast of Dorset (Curtis *et al.* 1976: Fig. 1.11).

Limestone is easily dissolved and washed away by rain water, so that soils can only form on bare limestone surfaces if the secondary minerals (the impurities in the limestone, such as quartz) can be prevented from washing away with the dissolved $CaCO_3$ (Curtis *et al.* 1976: 88). Although the loamy sand described in thin section may have had some loess material and colluvium added to it during its formation, the lack of bedding and sorting of particle sizes excludes the incorporation of any alluvium (*cf.* Waters 1992; Brown 1997;). The loamy sand thus appears to have developed mainly from the underlying parent material, broken up by micro-organisms, growing roots, water and temperature fluctuations; freeze-thaw cycles and the splitting action of roots can incorporate fragments of limestone into the soil (Curtis *et al.* 1976: 88-94; Limbrey 1975: 107-8). This soil is evidently rich in $CaCO_3$ inclusions, and yet remains slightly acidic (H. Lewis, pers. comm.). Its relatively low pH results from redox reactions (see below) in highly oxidising conditions (Brady 1984: 391), and explains the lack of shell and bone remains.

The British soils above oolitic deposits are classified as the *Sherborne* series soils, and described as shallow calcareous brown earths, with limestone within thirty-five centimetres from the surface (Curtis *et al.* 1976: table 1.11). Indeed, the soil seen in the excavated section (fig. 7) is not more than thirty-two centimetres deep. These shallow soils are historically associated with scrub woodland and heath, and were only relatively recently used for arable farming (Bridges 1978: 92-3).

Eluviation and Illuviation

As water moves through the soil pores it can detach clay particles adhered to the pore walls and transport them to lower depths of the profile (eluviation) (Bridges 1997: 35; Limbrey 1975: 52). When the water-clay complex reaches an environment which induces flocculation, the clay particles are deposited against the pore walls (illuviation) (*ibid.*). Clay is not the only textural component moved by water, and although it may not be the first to be detached from the groundmass, it is the last to be deposited again, once the water has reached minimal velocity (Waters 1992: 120). Since, in this case, the soil is very sandy and porous, water flows freely, depositing clay and other transported particles on sand grains as well as pore walls. If the soil structure is disrupted, by deforestation and/or tillage for example, rates of eluviation and illuviation will change. A high canopy and a thick layer of humus reduce the impact of water on the soil surface. If these are removed, water might dislodge soil particles as it hits the surface, and drain through the soil at greater velocities. The water is thus able to 'pick up' larger particles and carry them to lower depths than it was prior to soil disturbance. The clean clay deposited under stable conditions becomes coated with silt and fine organic matter, taking on a dusty or even dirty appearance (Curmi 1987: 251; FitzPatrick 1993: 184-5). Calcite ($CaCO_3$) also dissolves in water, especially if the latter is slightly acidic, such that decalcification is a common process during regolith weathering and soil disturbance (Brady 1984: 392). The present soil, however, is rich in many forms of $CaCO_3$, which have probably moved up the profile from the parent material, and precipitated near the surface through evapotranspiration and re-crystalization.

Redox Reactions and the Mobility of Iron within Soils

Iron is an essential element, present in organic and many inorganic compounds (Schwertmann *et al.* 2000: 13). In soils, iron is found either in its ferrous (Fe^{2+}) or ferric (Fe^{3+}) state (Loeppert *et al.* 1996: 639). Ferric, or oxidised, iron is a strong red colour and dominates in soils of high oxygen; whereas ferrous, or reduced, iron is a bluish-grey colour and present in anaerobic environments of low pH values. Reduced iron is mobile and tends to move towards areas of higher oxygen concentration, where Fe^{2+} is oxidised to Fe^{3+}. Such reactions are known as redox reactions. Manganese, another element ever-present in soils, also suffers the same redox reactions, changing from a mobile Mn^{2+} to a stable Mn^{4+}. Consequently, pans of indurated oxidised iron and manganese may form at the boundary between aerated and

waterlogged conditions, inhibiting movement of particles from one side to the other. (Breuning-Madsen *et al.* 2001: 693-5; Holst *et al.* 2001: 129).

Once oxidised, iron is quite stable and, compared to other mineral constituents, not easily leached (*cf.* Brady 1984; Curtis *et al.* 1976; Limbrey 1975). It can, however, move through the soil if mobilised by chelating agents, or when attached to clay (Limbrey 1975: 52; Loeppert *et al.* 1996: 639). The iron may react with the clay component, forming a clay/iron colloid, which reduces the clay's potential to leach (Limbrey 1975: 52). If an iron cation becomes bound to an organic molecule it forms a chelate complex, which not only renders it more mobile but also makes it available to plants (Brady 1984: 374). In the thin sections iron is present in various forms: coatings, nodules, sesquioxides and staining. Coatings occur when the clay/iron colloid is elluviated from other horizons and precipitated on pore walls and grains (Bullock *et al.* 1985; Stoops 2000). Plant respiration and the activities of soil organisms can also form iron and manganese (ferro-manganiferous) coatings and concretions (Courty *et al.* 1989: 180-5). Staining and sesquioxides occur when oxygen is gradually introduced; if the increase in oxygen is sudden, nodules will form (Gerard 1992: 96).

TRENCH 1

Samples 1.13 to 1.5 were taken from the paleosol, beneath the Roman bank (figures 6 and 7). Sample 1.16 comes from within the bank, above 1.13 and 1.14. The local loamy sand described through samples 1.13 to 1.16 is very porous, i.e. well aerated, and it is therefore not surprising to find the overall groundmass impregnated in ferric iron. The layer of clay seen in sample 1.15, lying above the bedrock, could be Forest Marble Clay: "the next succeeding geological formation above the limestone" (Curtis *et al.* 1976: 88). The clay band is mixed with *c.* 30% loamy sand, and is evidently not compact or thick enough to impede water percolating into the limestone since the naturally free-draining loamy sand shows no signs of water-logging for any prolonged period of time (*cf.* Courty *et al.* 1989; Curtis *et al.* 1976; Limbrey 1975). It may, however, have caused an increase in soil creep as less water is able to penetrate the clay and therefore runs off as soil water, transporting soil particles down-slope. Above the layer of clay, the loamy sand in sample 1.15 is free of any clay aggregates and coatings, indicating that clay has not moved up profile. 1.15 depicts the lower B horizon (Rapp and Hill 1998: 29-31).

The clean clay coatings in sample 1.13 are a tempting indication of a Bt horizon in a once stable brown calcareous soil under forest cover (French 2003: 230; Fisher and Macphail 1985: 99). Although the evidence is very scant, the successive coatings of increasingly dirtier clay do suggest the soil was once stable and then physically disturbed in some way, upsetting rates of illuviation (*ibid.*). Admittedly, and as was demonstrated by Milfred *et al.* in 1967, many more samples would have to be taken to evaluate such an interpretation (Murphy *et al.* 1987: 257). The soil is a healthy reddish-brown colour and does not portray any characteristics of a leached horizon (*cf.* Courty *et al.* 1989; Curtis *et al.* 1976; Limbrey 1975) or decalcification; it would appear to have stabilised under a turf line after the initial disruption.

The stratigraphy recorded in figure 7 shows a distinct turf horizon below the Roman bank, which is not obvious in thin-section. The only signs of a turf line in samples 1.13 and 1.14 are the frequent ferro-manganiferous nodules, presumably created by increased biological activity in the O and Ah horizons. Plant organs in sample 1.13 and 1.16 could date back to the Iron Age, having been preserved by iron impregnation (Macphail *et al.* 1998, 638), albeit preservation of organic matter in such an oxidised environment is unexpected. The combined macro and micro-evidences demonstrate that the soil was not truncated before the construction of the bank. Nevertheless, the absence of a clear boundary between the bank and *in situ* turf is not surprising, considering the effects of compression and soil mixing (Gerrard 1992, 203-7; Macphail and Goldberg 1995, 10).

Pre-Roman use of the surrounding area as agricultural land is more than likely, and the palaeosol, preserved from modern ploughing, may still contain signs of ancient farming practices. Ancient tillage marks, however, have not been seen in the field, nor are they discernable in the three thin-sections from the palaeosol (H. Lewis pers. comm.; Gebhardt 1995, 28-30; Lewis 1998). The groundmass in the thin-sections is homogeneous, both in consistency and aggregate size; no crusts, layering or planar voids are present, and although coatings and hypocoatings of fine groundmass material, as well as dusty and dirty clay coatings are frequent, these pedofeatures "may sometimes be created by other means" (Lewis 1998, 154, 175-93; Macphail *et al.* 1990, 55-9; Usai 2001, 546-52). The even distribution of fine charcoal could suggest the soil was mixed through tillage (Macphail 1991, 112-6). As at Rectory Farm, Lincolnshire, ash may have been added to the fields as a fertilizer (French and Coyle 1995), of which only charcoal is detectable; heavily mixed ash pseudomorphs may be 'hiding' in the

calcium carbonate rich soil. At Rectory Farm, however, other anthropogenic inclusions, including pottery and bone, confirmed human impact on the soil (*ibid.*). The close location of samples 1.13 and 1.14 to the 'ritual pool' may be of some significance. If the latter was used during the Iron Age and before for other than irrigation purposes, it may be that the present palaeosol was never cultivated, but instead kept as an area free of encumbering vegetation. It is perhaps over optimistic to search for signs of ancient agriculture from only two thin-sections (since (1.15) is probably too deep to have ever been disturbed by tillage implements) given the difficulties of recognition (*cf.* Carter and Davidson 1998, 2000; Macphail 1998).

Sample 1.12, from inside the arena, near the wall (fig. 5), shows two highly disturbed iron and manganese pans. Due to the disturbance of the stratigraphy, it is impossible to know how indurated these pans were, and how they affected pedological processes. The 'ritual pool' was built in a natural hollow with its centre at the deepest point (Lock and Gosden, in press). The water-level beneath the 'ritual pool' is argued to have always been very high, creating a permanently waterlogged centre (see chapter 2). The two bands of iron and manganese indicate two levels of standing water. The lowest might have formed during a drier year, the dry season or even after initial drainage by the Romans (*ibid.*). The iron-manganese bands slope away from the arena centre; their orientation will have to remain enigmatic until section 1.23 is re-opened. Whether these bands were ever open surfaces is problematical, not least because of the highly disturbed environment. An open surface would certainly increase the rate of iron and manganese oxidation, though one might not expect it to form an indurated pan. Unfortunately, all signs of a trampled surface, if ever there were any, have been erased through bioturbation. It is possible that the upper band was once a surface whilst the lower one reflects the level of the water table. It may also be the case that the water table reached the surface before the drain was installed, so that the band(s) reflect both an open surface as well as a layer where an anoxic environment is suddenly oxidised. The presence of small remains of copper artefacts both within and between these bands could indicate an open surface. Conversely, these artefacts are more than likely to have been moved up and down the profile, as well as laterally, by soil fauna. The question of open surfaces cannot be answered at present, and should be explored through further excavation and sampling for micromorphology. One certainty is that the bands formed prior to extensive bioturbation.

The fine gravel and 'ash' in the upper most section of the slide probably originate from the gravel floor spread by the Romans to create a drier surface (*ibid.*). Sand grains have moved lower down through gravity and the mixing consequences of bioturbation. The same 'ash' is also seen in fabrics 18.09 **b** and 18.11 **a**, and looks quite different to the unmistakable ash in 18.11 **c** (Canti 2003: 341). It is possible that a type of cement was fabricated by mixing ash with limestone, and spread on surfaces to create a white, sterile floor. It is also possible that ash was not used, and that the 'ash' is in fact finely crushed limestone. Building materials were never standardised in the Romano-British world, availability being a determining factor of choice (Burnham 1988: 35-59).

TRENCH 9

Sample 9.25 points to at least two sources for the provenience of bank construction material. The top half of the slide contains well oxidised loamy sand, rich in ferro-manganiferous nodules, suggesting it was probably a turf (see above). Below, the next fabric has localised areas of iron oxide, in the form of nodules, staining and sesquioxides with gradual boundaries. The latter two, as mentioned above, indicate slow, gradual fluctuations of the water-table. Nodules may also have formed *in situ*; though it is possible they were transported from above, along with the two pieces of corroded copper. The remainder of the groundmass is a golden-brown colour, evidently leached of iron and organic matter. This fabric must have been obtained from an area with fluctuating water levels. Forming the boundary between fabrics **a** and **c** is a thin, porous layer of granular iron and manganese oxides (recorded in the field – see table 1). Analysing the 'turf-filled' funerary shaft at St Albans, Macphail *et al.* (1998) noticed that "The process of ferruginisation and iron panning has been particularly pronounced towards the base of the 'turf' deposits" (p.638). Iron pans can form as a result of hydrological discontinuity at the boundary between fabrics of varying porosity (Breuning-Madsen *et al.* 2000: 8; Macphail 1986: 69-70). When water movements are inhibited or slowed down, iron may accumulate and turn ferric as levels in oxygen gradually increase (*ibid.*). Fabric **d**, at the end of sample 9.25, shows another layer of soil, very similar to the above fabric **a**. During the 2001 excavations, it was first thought that this lower component (context (9064)) was the original surface upon which the bank was constructed. Fragments of Roman tiles were then found, and it was re-assessed as bank material (table 1). (9142), below (9064), is now believed to represent the buried soil. The irregular boundary between fabrics **c** and **d** also suggests the

materials were 'dumped' one on top of the other. The fragments of corroded copper in fabrics **a** and **b** were probably re-worked into the bank through bioturbation, either from context (9064) or the surface. Local soil, from at least two different hydrological systems, was used to build the bank.

TRENCH 18

Sample 18.09 was taken to examine the nature of the 'mortar' floor from sector 4, (fabric **b**). From the thin-section, it is evident that the floor has been disturbed and partially integrated into the over- and under-lying fabrics. It is also considerably thinner than the section drawing suggests (fig. 12, plate 16). The 'mortar' was made of local limestone and 'ash' (the same as that described in sample 1.12), which seems to have been carefully made as a type of calcium carbonate cement and spread to create a compact, clean surface (plate 16). Unfortunately, no characteristic features of a trampled floor remain (*cf.* Mathews 1995; Matthews *et al.* 1997). The floor was constructed on top of natural soil, seen in fabric **c**.

Sample 18.10, taken from above 18.09 (fig. 12), is not composed of silt as was described in the field, nor does it contain any 'mortar' (plate 17). The fabric in 18.10 is loamy sand, also visible in 18.09 **a**, above the 'mortar' floor. When and how this layer was deposited is difficult to say, since the only signs of anthropogenic influence are 12 small pieces of corroded copper. Looking at the stratigraphy (fig. 12), context (18013) could represent the natural, post-abandonment, build-up of soil cut by a feature of unsure date. Artefacts resting on the surface of the 'mortar' floor would easily become incorporated into the aggrading soil, by natural and/or cultural (such as ploughing) processes.

Sample 18.11 represents a series of floors within sector 13 of the building(s) in Trench 18 (figures 9 and 10), without any indications of burnt deposits. Fabric **c** is a massive horizon of ash mixed with un-burnt limestone fragments. The vertical cracks in this layer could be a consequence of wetting and drying, but also suggest a trampled surface (Matthews *et al.* 1997: 286). No horizontal planar voids were noticed, although most of the charcoal and sand grains are horizontally oriented. There are a few dense pockets of faecal spherulites which may point to dung as a source of fuel (Macphail *et al.* 2004: 179). The absence of phytoliths, however, does not support this interpretation (*ibid.*).

The relatively pure upper layers of ash were not recorded in the field, only the increasingly iron impregnated lower layers were noticed, and described as burnt loam (table 1). These layers are covered in amorphous iron, without any "rubified coarse and fine mineral material, (...), caused by structural disruption during heating and resulting segregation of iron oxides." (Simpson *et al.* 2003: 1408). The lack of phytoliths, burnt stones, burnt soil and iron nodules all demonstrate the absence of a burnt horizon. Instead, the increase in iron can be explained by the change in fabric texture between the ash and underlying iron-rich soil; iron oxides accumulating near an open surface where levels of oxygen are highest.

The underlying soil has horizontally oriented charcoal and amorphous organic matter at its boundary with the ash floor. Their orientation could be a result of compaction from the floor above. However, the possibility of it being another floor surface will have to be addressed with further sampling.

Resting on the top right-hand corner of the ash floor is a fragment of corroded copper, possible *in situ* (plate 18c). It was deposited along with soil particles, organic matter and other smaller pieces of corroded copper. Fabric **b** is not another burnt layer; its dark brown/black colour reflects its high quantity of amorphous organic matter. The relatively massive texture and horizontal orientation of particles indicate that **b** built up during the use of the building/room. This layer covers almost the entire interior of the structure and not only the area visible in plate 9 (P. Daly pers. comm.). Regular wetting is suggested by the incipient crust of $CaCO_3$, lying within **b** at about half a centimetre above the ash floor. $CaCO_3$ is transported by water to be re-precipitated where levels of oxygen increase (Courty *et al.* 1989, 176-9). Water percolating down the layer (visible from the calcitic partial infillings of pores) temporarily accumulated over the ash floor due to the change in porosity between the two fabrics, which resulted in the accumulation of $CaCO_3$ at the boundary between greater and lesser oxic conditions. The 'soil floor' may have been wetted to keep the dust down, instead of being swept for fear of removing the ash surface. It is unlikely that the 'soil floor' was exposed to rain, since the absence of loess and alluvium suggests the building/room was roofed (Matthews *et al.* 1997: 292-3).

Although faecal spherulites are present, phytoliths, excrement, dung and phosphatic pedofeatures are absent, showing this room was not a stable (Guélat *et al.* 1998: 176; Macphail *et al.* 2004:179-81), nor does it seem to have been used as a lavatory. The spherulites were probably brought in with soil from people's shoes.

The quantity of organic matter may be surprising for a non-domestic building (see chapter 2). From this single thin-section, it seems that people (possibly those who worked in the building and/or their customers) walked into this room, carrying in dirt from outside and let crumbs fall from their food. They do not seem to have minded the obvious smell and accumulation of soil and rotting organic matter. How long before this deposit was sealed by fabric **a** is impossible to say. The probability that this building had no eastern wall, however, might suggest that the accumulation of dirt was relatively rapid, at least compared to a building with restricted access. It is interesting to note that sample 18.09, from the southern building in Trench 18 and where the same absence of an eastern wall was noted (see chapter 2), does not contain any compact layers rich in organic matter.

Fabric **a** is another 'mortar' layer, and is composed of un-burnt limestone, loamy sand, charcoal and the same 'ash' seen in samples 1.12 and 18.09**b**. The soil in fabric **a** appears to have been intentionally added since the absence of clay coatings in **b** below demonstrate particles have not been transported down profile. The absence of clay coatings in **b** also suggest that it was no longer thought necessary to dampen the floor by splashing it with water. After abandonment of the building, that area of the floor must have been covered, perhaps by collapsed wall debris, and protected from direct rain. Soil was perhaps added to gravel in an attempt to create a solid floor, a type of calcium carbonate cement, more resistant to wear than ash. **a** is not extremely compact, however, nor does it show any obvious signs of trampling. The fabric is perhaps too coarse to be noticeably affected by trampling, or it may simply not have been walked on persistently. Macphail *et al.* (2004) noted that, according to use of space, degrees of compactness differed between areas within a house (p.184).

Sample 18.12, from bellow the Roman floors described above, contains no signs of anthropogenic origins. In fact, its contents can be summarised as a limestone pebble and natural loamy sand, slightly compacted from overlying sediments (plate 19). As in the above sample, evidence for burning is absent. The loamy sand probably represents the Iron Age soil on which the structure was built, but a conclusive interpretation cannot be given until excavations continue below the level of excavation shown in plan 18.14 (figures 9 and 10).

CONCLUSION

Roman sites in England are too numerous to evoke, and yet very few Roman floors have been sampled for micromorphology, specifically for the analysis of floor materials, human occupation deposits and use of space. These approaches are common in the Near East, where arid conditions and the permanent abandonment of settlements have led to exceptional preservation of materials. Complete floors and *in situ* deposits have encouraged geoarchaeologists to sample systematically for micromorphology, with extraordinary results (*cf.* Mathews 1995; Matthews 2003, 174-9; Matthews and Postgate 1994; Matthews *et al.* 1997). I believe that the absence of such systematic sampling for micromorphology on Roman sites in England is not due to the lack of excellent preservation, for indeed many sites have survived surprisingly well, but rather because of conflicting interests. When has an archaeologist not carefully removed rubble, 'burnt' and other layers, in hope and growing excitement of finding a tessellated floor or remains of painted wall plaster? This latter comment may be outdated, especially as investigative techniques such as micromorphology, phosphate analysis and magnetic susceptibility become increasingly integrated into excavation plans. Nevertheless, the overall impression is that micromorphology is not needed to investigate Romano-British floors, since the function and use of a site (which have been extensively studied by both archaeologists and historians) can usually be clarified through the architectural remains.

Micromorphology work on Romano-British settlements has mainly focused on describing and understanding the 'dark earth' phenomenon, which is not restricted to Roman sites (*cf.* Macphail 1981; Macphail 1983; Macphail 1994; Macphail *et al.* in press; Yule 1990). French and Coyle's (1995) work on the Roman villa at Rectory Farm, Lincolnshire, did aim to investigate the use of space within the building and the nature of construction materials, but unfortunately no relevant clues were found in their samples. Macphail (1991) took box samples from Maiden Castle and found good evidence for Bronze and Iron Age agricultural use of the land (p.106-18). Roman deposits, including a Romano-British temple overlying a probable circular Iron Age shrine (Lewis 1966, 49), were not targeted. At Courage's Brewery, Southwark, "a fragment of plaster-coated *opus signinum*, truncated bases of *in situ* brickearth clay walls, and a brickearth clay floor" (Macphail 1994, 15) were sampled along with other deposits, but descriptions were directed towards explaining the formation of dark earth directly above them (*ibid.* 15-20).

Dark earth is common, though not restricted to, urban deposits and "represents a marked break in the continuity of normal urban land use" (Macphail 1983, 245). In the field, it appears as a dark, sometimes black, loamy soil, often rich in artefacts and organic matter (*ibid*; Yule 1990, 620). Dark earth has been associated with midden deposits, including cess material, and natural soil, brought in from elsewhere to permit cultivation of restricted areas within urban settlements. Macphail (1994) has proposed a model of pedological reworking to explain the lack of Late Roman deposits (p.25). The model shows how easily soil fauna could have degraded and incorporated human occupation levels into a growing dark earth (*ibid.*). At Marcham/Frilford dark earth was not found to cover any Roman remains, although, presumably, if a layer of dark earth had accumulated it would now be an integrated component of the modern ploughed soil. The closest deposit to a dark earth is the organic-rich soil from sample 18.11, Trench 18. Despite lacking anthropogenic inclusions other than the pieces of corroded copper, 18.11 **b** is similar to the dark earth found over a clay floor at Courage's brewery (Macphail 1994, 20). 18.11 **b**, as mentioned in chapter 5, built up during the use of the building. Such organic surfaces have been described from Medieval houses in Cambridgeshire (Milek 1997, Milek and French 1998, de Vareilles 2004), and it is interesting to note that the concept of cleanliness they represent may not portray a loss of 'Roman' values. One must remember that Roman culture, *sensu stricto*, was initially a foreign culture, and although archaeology, through artefacts (namely pottery) and architecture, shows it to have been easily adopted, the effect it had on local people's basic attitudes to life is difficult to assess. A micromorphological study of the use of space in Romano-British buildings of varying social complexity could be extremely informative on the concept of hygiene held by different people in different rooms and buildings throughout the Roman period. 18.11 **b** also demonstrates that the origins of dark earth accumulation should perhaps be sought in the floor deposits themselves (where appropriate), and not as a uniquely post-abandonment phenomenon.

Sample 18.11 does not exclude the possibility that the buildings in trench 18 were used for "feasting and food consumption" (Lock and Gosden, in press; see chapter 2 above), especially since fabric **b** extends over most of the structure (see chapter 5). In fact, the accumulation of organic matter and copper objects (probably personal belongings, such as jewellery) is likely to have accumulated in an area where people handled food in some way, whether it be preparing, eating or buying to eat elsewhere or offer at the temple. Instead of cleaning up the debris, water was splashed onto the floor.

This action may have initially served to keep the ash floor from dusting up, and also to remove dirt. Ironically, however, as remains accumulated and were trampled on, water running through them increased their stability as a solid, flat surface. The addition of a gravel floor on top of 18.11 **b** could mark a change in the use of the building/room. The latter was probably the last floor added to the building before abandonment, since no other floor deposit was excavated. The openness of both buildings in trench 18 could lead one to identify them as stables for visitors to the temples, but no signs of any animal presence were seen in either of the samples. The natural soil seen in sample 18.12 (below 18.11), as well as the soil just visible at the bottom of 18.11, demonstrate that the ash floor was the room's first intentional fabricated surface. None of the fabrics analysed from 18.11 represent any burning event, as was suggested in the field, and I am glad to confirm that the building/room was not destroyed or abandoned.

Sample 18.09 contains only one floor surface, which currently appears to have been the only floor of that room. This floor was of a higher quality than any of those described in sample 18.11, and could indicate that the different buildings or rooms within trench 18 had different functions. Whether there is any temporal relationship between the various floors is a question that remains to be addressed by the excavators. Sample 18. 10 did not capture any of the floor material, as was intended in the field, but shows loamy sand with randomly distributed fragments of corroded copper. These artefacts may suggest that the same sort of deposit as 18.11**b** was building up above the gravel floor before abandonment. All the organic remains have long since disappeared in the oxic soil and no traces of any depth of waste accumulation is visible. 18.10 is not a layer of compact silt, as was recorded in the field (see table 1).

The buildings in Trench 18 offer a great opportunity for a micromorphological approach to understanding their use through time. Many more samples should be taken, targeting specific areas or arranged along a grid system. A combination of the two may turn out to be the best approach, so that features of interest can be more heavily sampled, as well as small room and corners missed by the grid. Phosphate analysis could also be done and reveal which areas were 'cleaner' than others. It would be a shame not to make the most of this opportunity, bearing in mind the information already obtained from only four samples.

Sample 1.12 confirms the existence of a high water-table during the Roman period. It also confirms that a gravel floor was added above the water-logged levels. The two iron and manganese pans do not exclude the idea that the 'ritual pool' was drained

before the addition of a dry surface, reflecting a probable change in use of the area. Excavations stratigraphically below sample 1.12 should be done carefully, bearing in mind the possibility of good preservation, especially that of organic remains, due to the high water-table. It may also be worth sampling the arena for diatoms to investigate the quality and stability of the water. It would be very interesting to find a correlation between regular renewing of fresh water with the instalment of the drain. Diatoms could also inform us on when in prehistory or history the 'arena' was stripped of its natural vegetation.

Samples 1.16 and 9.25 reveal two of the materials out of which the Roman bank was constructed: local turf and temporarily water-logged soil that may have been extracted from the natural coomb. In the field it was obvious that lenses of red sand and clay had also been added in order to create a stable, coherent bank (H. Lewis pers. comm.). The overall quantity of corroded copper found in most of the samples is an indication of how many more offerings were made at Marcham/Frilford. The large amounts of jewellery and other metal artefacts excavated are only a small proportion of the total lost or offered during visits.

Samples 1.13, 1.14 and 1.15 are a very narrow representation of the once stable calcareous brown soil, which was probably first deforested, by natural and/or human impact, in the Early Holocene (*cf.* French 2003, 196). It is likely to have been used as agricultural land by Bronze and Iron Age people, although nothing in the three samples from the palaeosol undoubtedly relate to such activities. Ideally, further samples should be taken, not only from beneath the bank but also under the Roman structures. It may be useful to also take comparative samples nearer to the river Ock, where alluvium has probably buried ancient soils and where modern human impact is less intense. To gain a better understanding of the palaeosol, pH should be measured and SEM/EDXTRA (scanning electron microscope with an energy-dispersive X-ray analytical facility) could be used to provide a relative concentration of elements present. Bulk samples could be taken to measure the quantity of organic matter through loss on ignition. As mentioned in chapter 3, an accurate estimate of organic matter is difficult to obtain from the thin-sections because of the overall concentration of iron present. Finding more or less organic matter would help explain the distribution of iron, and may provide stronger evidence for the presence of an *in situ* turf horizon observed in samples 1.13 and 1.14 (Courty *et al.* 1989, 180-1). A greater understanding of the soil make up would contribute immensely in explaining why certain signs of pedogenesis and anthropogenic

influence are present, whilst others are missing, and what type of palaeoenvironmental indicator (pollen or molluscs for example) one might sample for.

The interpretations reached in this report should be viewed as preliminary, until further samples are obtained and discussed in conjunction with archaeological data, which are, at this very moment, still being retrieved. The descriptions in the appendix should be consulted and compared to if more micromorphological samples are taken. The ten thin-sections analysed here cannot, by themselves, provide concrete explanations as to the meaning and function of individual rooms and the religious complex that was Marcham/Frilford. Nevertheless, I hope that the quantity of information obtained, as well as the potential micromorphology has for providing, confirming and/or refuting archaeological interpretations, will encourage excavators to welcome the method as an important and rewarding investigative technique. Marcham/Frilford is a truly interesting site, spanning from potentially the Neolithic, up to and right through the socially complex and ever changing Roman era, to the beginnings of the Anglo-Saxon period. This site has the potential to provide us with unique information on religious practices through an important stretch of the British past; it would be a shame, therefore, not to investigate it with tools capable of extracting even the smallest and indirect evidence safely retained within the archaeological layers.

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APPENDIX

In the appendix are the descriptions of the thin-sections sampled from Marcham/Frilford in 2003 by Dr. Lewis. They were described by the author under the guidelines of Bullock et al. (1985) and Stoops (2000). The context numbers refer to those identified in the field; the fabrics are those recognised during analysis. Percentages represent visual estimates of occupied areas. The c/f limit is 100μm. All quartz is sub-angular and limestone fragments are rounded.

Trench 1

Sample: 1.16 **Context**: 1185

General Observations
The sample presents a section of loamy sand, equal throughout the slide. The fabric has a high content of loosely packed mineral grains, held together by thin coatings and irregular aggregates of fine groundmass. The clay is rich in iron and manganese oxides. Localised areas with a higher concentration of amorphous iron are common.

Microstructure
Tending towards granular or crumby

Porosity: 35-40%
- Vughs are dominant
- Few channels, indicating some bioturbation

Groundmass
c:f ratio - 2:1
c/f related distribution: fine to equal enaulic
Sand:silt:clay – 10:1:2

Mineral Component
Coarse material: 35-40%. Well to moderately sorted, unoriented
Predominantly quartz, few limestone fragments (1000 - 100μm)
- 2-5% coarse sand, mostly limestone
- 20-25% medium sand, mostly quartz
- 15-20% fine sand, all quartz
- very few shell fragments, <2mm in length

Fine material: 15-20%
- 2-5% very fine quartz sand, 50-100μm
- 2-5% micrite and microsparite
- 2-5% silt
- 5-10% clay

Colour: (XPL) reddish-brown
(PPL) yellowish-brown
Limpidity: dirty
b-fabric: microcrystallitic (calcitic)

Organic Matter: 10-15%
- few organic punctuations, <50μm
- very few amorphous organic matter, not impregnated by iron oxide and therefore still visible within the groundmass
- 1 plant organ, *c.* 4mm long, either well preserved or fresh as it maintains quite a high degree of birefringence but is partially impregnated with iron
- few charcoal fragments, <100μm; very few are 100-250μm in size

Pedofeatures

Textural

- All sand grains have fine internal and external hypocoatings of groundmass material
- The clay fraction occurs predominantly as non-laminated, dusty grain coatings, cementing the minerals together

Amorphous

- Frequent dark brown sesquioxide granules with gradual boundaries
- Few iron nodules
- Frequent ferro-manganiferous nodules, 10-500μm

Fabric

- All voids have loose discontinuous infillings of fine groundmass material

Sample: 1.13 **Contexts**: 1185/1153

General Observations

This slide cannot strictly be separated into two units. (1185) is dominant, giving this slide an almost exact resemblance to 1.16. The difference, however, is an increase in secondary $CaCO_3$ and clay aggregates towards the bottom of the slide. There is also a slight increase in porosity, with two channels (*c.* 3cm long, 750-3000μm wide, and 2cm long, 500-3000μm wide respectively) running down either side of the slide. 3 plant organs (<750μm long) of moderate birefringence, partially to completely impregnated in iron are visible. Ferro-manganiferous nodules (10-350μm) are frequent to common from top to bottom of the slide respectively.

Clay aggregates: orangey-gold (XPL), showing a striated orientation; moderate degree of birefringence; dusty with silt and organic punctuations, and moderately impregnated with iron. The aggregates are irregular, unaccommodating, and 100-4000μm in size. <2% grains have hints of clear clay coatings, followed by dusty then dirty clay.

Sample: 1.14 **Context**: 1153

General Observations

This slide is composed of (1185), as the above samples. About 1/3 down the slide however, the groundmass and 60% of sand grains appear heavily coated in strong red (XPL) iron oxide. This coating is so dense and homogenous that the microcrystallitic b-fabric is no longer visible. There are no aggregates of orangey-gold clay, although thin coatings of yellow silty clay remain visible around the rubefied aggregates of fine groundmass, grains and pores. There are very few charcoal fragments, <125μm in size.

Sample: 1.15 **Contexts**: 1153/1165a **Fabrics: a, b**

General Observations
Fabric **a** is the same fabric seen in the previous slides: (1185). Clay aggregates and coatings, and ferro-manganiferous nodules are not present. Its boundary with fabric **b** is clear, distinct.

Fabric **b** is a layer, *c.* 8mm wide, at the bottom of the slide, of clay mixed with manganese, and *c.* 30% of fine groundmass from fabric **a**. The orangey (XPL) clay of moderate birefringence is the same as that seen in slide 1.13, except that instead of occurring as irregular aggregates it forms a more compact layer of reduced porosity (20-25%). The manganese oxides and hydroxides cause the clay to appear duller and more opaque.

Sample: 1.12 **Contexts**: 1160/1163 **Fabrics: a, b**

General Observations
Fabric **a** appears to be loosely dumped loamy sand. There is no specific orientation of sand grains, which are randomly distributed.

Microstructure
Intergrain microaggregate

Porosity: 30-35%
- complex packing voids are dominant
- few vughs within the groundmass, <100μm in size
- very few channels, indicating some bioturbation

Groundmass
c:f ratio - 2:1
c/f related distribution: gefuric
Sand:silt:clay – 10:1:2

Mineral Component
- 2 pieces of corroded copper (same characteristics as the artefact described in 18.09 **b**), 250μm and 350μm in size, between the two layers of fabric **b**

Coarse material: 35-40%. Poorly sorted, unoriented
Predominantly quartz, limestone fragments are frequent (1000 - 100μm)
- <2% fine gravel
- 2-5% very coarse sand
- 2-5% coarse sand
- 10-15% medium sand
- 10-15% fine sand
- 1 section through a complete mollusc shell
- 1 bone fragment, 175μm long

Fine material: 15-20%

- 10-15% very fine quartz sand, 50-100μm
- 2-5% micrite and microsparite
- <2% silt
- 2-5% clay

Colour: (XPL) brown speckled with reddish-brown
(PPL) lighter brown speckled with reddish-brown
Limpidity: dirty
b-fabric: calcitic (microcrystallitic) silty clay

Organic Matter: 10-15%

- organic punctuations are common, <50μm
- very few charcoal fragments, <100μm

Pedofeatures

Textural

- All sand grains are at least partially coated in groundmass material

Amorphous

- Frequent dark brown sesquioxide granules with gradual boundaries
- Few iron nodules

Excrement

- 1 earthworm cast

Boundary: there are no distinctive boundaries between fabrics **a** and **b**, the latter being distributed as loose aggregates within the former in two bands or layers. Between these two layers, and following their general orientation, is a channel, *c.* 3cm long and 500-2000μm thick, where the earthworm cast was seen.

Sample: 1.12 **Fabric: b**

General Observations

Fabric **b** represents two layers, crossing the slide at 225° from the right side. These layers are essentially made up of fabric **a** with a high concentration (>70%) of oxidised iron and manganese. The uppermost layer is mixed with loamy sand and includes a few limestone fragments, <1cm across, and localised patches of what could be ash (grey with low birefringence in XPL), acting as a background to sand grains and shell fragments.
Both bands have 1 piece of corroded copper, *c.* 500μm in size

Trench 9

Sample: 9.25 **Contexts**: 9057/9058/9064 **Fabrics: a, b, c, d**

General Observations
The slide from trench 9 is composed of four fabrics, displayed from top to bottom as **a** (*c.* 7cm thick), **b** (*c.* 3mm thick), **c** (*c.* 4cm thick), and **d** (*c.* 2cm thick). The whole slide represents the local loamy sand, with few signs of anthropogenic influence.

Fabric a: exactly the same as (1185). Ferro-manganiferous nodules are dominant. 2 pieces of corroded cooper, both 100μm in size are present. A section through a complete mollusc shell is visible. Its boundary with **b** is clear, distinct.

Fabric b: a layer of deep red iron and black manganese (XPL) impregnated groundmass, too granular and thin to be an iron pan. All the sand grains within this incipient pan are coated in iron. Its boundary with **c** is clear, prominent.

Fabric c: the same as **a**, except only 5-10% of the groundmass is stained with patches of amorphous iron, and there are less sand grains (20-25%) and more clay (15-20%). The clay is golden-brown, weakly reticulate striated and with moderate to high birefringence. It appears mostly as unaccommodated aggregates with few dusty coatings around pores and grains. One aggregate, *c.* 2.5mm in size, has cleaner, pale yellow striated clay of high birefringence, coated with iron. The clay appears in small clusters, with parallel basic orientation within these clusters, and is also found as coatings around the sand grains of this aggregate. Sesquioxides in **c** are common (as opposed to frequent in **a**), and very few iron nodules are present. 2 pieces of corroded copper, 50μm and 100μm in size, were noticed.
Its boundary with **d** is diffuse, distinct and undulates.

Fabric d: same as fabric a, but with less fine groundmass (10-15%) and more coarse minerals (40-45%). Few ferro-manganiferous nodules (10-300μm).

Trench 18

Sample: 18.09 **Contexts**: 18013/18101/18102 **Fabrics: a, b, c**

General Observations
a is layer of loamy sand, *c.* 2cm thick, generally the same as that seen in sample 1.16. It is, however, less heavily impregnated with iron, and has very few ferro-manganiferous nodules.

Microstructure
Vughy

Porosity: 20-25%

- Vughs are dominant

Groundmass
c:f ratio – 1:1
c/f related distribution: porphyric
Sand:silt:clay – 9:3:1

Mineral Component

- 11 pieces of corroded copper, <50-250μm in size

Coarse material: 25-30%. Poorly sorted, unoriented
Predominantly quartz, few limestone fragments (4000-100μm)

- <2% fine gravel
- 2-5% very coarse sand
- 2-5% coarse sand
- 5-10% medium sand
- 10-15% fine sand

Fine material: 30-35%

- 5-10% very fine quartz sand, 50-100μm
- 5-10% micrite and microsparite
- 2-5% silt
- 10-15% clay

Colour: (XPL) golden brown with patchy areas of stronger reddish-brown
(PPL) light brown with patchy areas of brown
Limpidity: dirty
b-fabric: microcrystalitic (calcitic)

Organic Matter: 5-10%

- few organic punctuations, <50μm
- amorphous organic matter is common
- few charcoal fragments, <200μm

Pedofeatures
Textural

- 90-95% sand grains have fine internal and external hypocoatings made up of groundmass material

Amorphous

- Few dark brown sesquioxide granules with gradual boundaries
- Very few iron nodules

Fabric

- All voids have loose discontinuous infillings of fine groundmass material
- <2% of the groundmass is coated in iron oxide.

Boundary: clear, distinct and straighter (horizontal) than **b**'s boundary with **c**.

Sample: 18.09 **Fabric: b**

General Observations
This layer, *c.* 1cm thick, is composed of bioclasts, medium to fine quartz, a few larger pieces of oolitic limestone (1cm in size), and possibly ash (2-5%, the same as that in 18.11 **a**). The grains are loosely packed together, having been disturbed after deposition. There is no soil in this layer. 4 pieces of corroded copper, 100-300μm in size were counted.
Colour: (XPL) yellowish-grey
(PPL) light grey
There are two grains of oolite, both 1.5cm in size, lying almost parallel to this layer but just below it, in fabric **c**.
b's boundary with **c** is clear, prominent. The two fabrics are moderately intermixed at this irregular boundary.

Sample: 18.09 **Fabric: c**

General Observations
c is a layer of loamy sand, *c.* 4cm thick, almost the same as fabric **a**, only more broken up/disturbed.

Microstructure
Tending towards granular

Porosity: 30-35%
- Vughs are dominant
- Channels are common, indicating some bioturbation

Groundmass
c:f ratio - 1.5:1
c/f related distribution: porphyric
Sand:silt:clay – 4:1:2

Mineral Component
Coarse material: 25-30%. Poorly sorted, unoriented
Predominantly quartz, few limestone fragments (2000-100μm)
- <2% very coarse sand
- 2-5% coarse sand
- 5-10% medium sand
- 10-15% fine sand
- very few mollusc shell fragments, <500μm long
- very few bone fragments, <300μm in size

Fine material: 20-25%
- 2-5% very fine quartz sand, 50-100μm
- 2-5% micrite and microsparite
- 2-5% silt
- 5-10% clay

Colour: (XPL) reddish-brown
(PPL) lighter reddish-brown
Limpidity: dirty
b-fabric: microcrystallitic (calcitic)

Organic Matter: 10-15%

- few organic punctuations, <50μm
- possible iron stained amorphous organic matter (the overall iron impregnation of the groundmass makes it difficult to determine the presence of organic matter)
- few charcoal fragments, <200μm

Pedofeatures

Textural

- 90-95% sand grains have fine internal and external hypocoatings made up of groundmass material

Amorphous

- Frequent dark brown sesquioxide granules with gradual boundaries
- Few iron nodules

Fabric

- All voids have loose discontinuous infillings of fine groundmass material

Excrement

- 1 or 2 earthworm casts

Sample: 18.10 **Contexts**: 18101/18102

General Observations

This slide consists of a single fabric: the same loamy sand found in sample 18.09, fabric **a**. 12 pieces of corroded copper, 50-400μm in size, were counted.

Sample: 18.11 **Contexts**: 18027/18050/18051 **Fabrics: a, b, c**

General Observations

Fabric **a**, *c.* 2cm thick, is mainly composed of large sand grains, loosely packed together, within a sparse groundmass of loamy sand and possible patches of ash.

Microstructure

Intergrain microaggregate

Porosity: 25-30%

- Vughs are dominant
- Small simple packing voids are common

Groundmass
c:f ratio - 1.5:1
c/f related distribution: equal enaulic
Sand:silt:clay – 10:1:1

Mineral Component

- 5 pieces of corroded copper, 100-400μm in size

Coarse material: 35-40%. Poorly sorted, unoriented
Predominantly limestone, quartz is common (3000-100μm)

- <2% fine gravel
- 5-10% very coarse sand
- 2-5% coarse sand
- 15-20% medium sand
- 10-15% fine sand

Fine material: 25-30%

- 10-15% very fine quartz sand, 50-100μm
- 10-15% micrite and microsparite
- 2-5% silt
- 2-5% clay
- 2-5% fine, medium to dark grey crystals, possibly ash, lightly coated in yellow clay

Colour: (XPL) a speckled mix of reddish-brown, white and black
(PPL) a speckled mix of brown and black
Limpidity: dirty
b-fabric: microcrystallitic (calcitic)

Organic Matter: 10-15%

- frequent organic punctuations, <50μm
- amorphous organic matter is common
- charcoal is frequent, <750μm

Pedofeatures
Textural

- 90-95% sand grains have thin coatings and hypocoatings of fine groundmass material and dusty, non-laminated clay

Amorphous

- Frequent dark brown sesquioxides with gradual boundaries, within the soil groundmass
- Few iron nodules

Fabric

- 75-80% voids have loose discontinuous infillings of fine groundmass material

Boundary: with fabric **b** is clear, distinct. In PPL a sharp, horizontal boundary, showing a sudden change to a darker brown in **b**, is visible.

Sample: 18.11 **Fabric: b**

General Observations
This layer of soil, *c.* 3cm thick, is very similar to (1185), but greatly mixed up with charcoal and organic matter. It is also more compact, and contains traces of a copper artefact at the bottom right hand corner. The main difference between this fabric and **a** above, is the increase in organic matter. **b** is also more sorted, with a reduced size range of particles, which have no clay coatings.

Microstructure
Vughy

Porosity: 15-20%
- vughs are dominant
- few channels

Groundmass
c:f ratio: 1:1.5
c/f related distribution: double spaced porphyric
Sand:silt:clay – 10:1:1

Mineral Component
- 1 fragment of corroded copper, *c.* 7mm long (lying parallel to fabric **c**) and 1cm wide. Colour: (XPL) light to medium second order green; (PPL) second order yellowish green. It has dark streaks of what could be iron and manganese, and a very low birefringence.
- 5 pieces of corroded copper, 50-250μm in size

Coarse material: 25-30%. Well to moderately sorted, unoriented
Predominantly quartz, limestone is common (2000-100μm)
- <2% very coarse sand
- 2-5% coarse sand
- 5-10% medium sand
- 5-10% fine sand
- very few fragments of egg shell, <500μm long

Fine material: 30-35%
- 10-15% very fine quartz sand, 50-100μm
- 10-15% micrite and microsparite
- 2-5% silt
- 2-5% clay
- 7 faecal spherulites, *c.* 10-25μm in size (all seen in pores)

Colour: (XPL) reddish-brown speckled with white and black
(PPL) brown speckled with black
Limpidity: dirty
b-fabric: microcrystallitic (calcitic)

Organic Matter: 20-25%

- frequent organic punctuations, <50μm
- frequent amorphous organic matter
- charcoal is dominant, mostly <1250μm, 1 is 5000μm

Pedofeatures

Textural

- 85-90% sand grains have coatings and hypocoatings of fine groundmass material
- *c.* 2cm down from fabric **a**, there is a zone of irregular aggregates (200-1500μm) with diffuse boundaries of densely packed micrite. Within these aggregates, denser bands of micrite (100-150μm thick) coat sand grains and pores
- amorphous organic matter and charcoal close to fabric **a** are horizontally oriented

Amorphous

- Few dark brown sesquioxide granules with gradual boundaries
- Very few iron nodules

Fabric

- <5% of vughs have loose discontinuous infillings of fine groundmass material
- *c.* 5% of vughs, especially those nearer to fabric **a**, have very few accumulations of partially iron stained micrite.

Boundary: with fabric **c** is diffuse, faint.

Sample: 18.11 **Fabric: c**

General Observations

This is a compact layer of anthropogenic origin, *c.* 1.5cm thick. It consists of limestone, quartz and ash mixed together to form a type of mortar or slurry. At the bottom left hand corner of **c**, and partly merging into the underlying soil, is a large fragment of limestone (1.5cm across), which was probably part of the anthropogenic mix.

Microstructure

Crack, turning to crumb structure towards the bottom of the layer

Porosity: 15-20%

- vertical cracks are dominant, 3 of which cover the whole width of the layer; <50-250μm wide, 750-1000μm long
- vughs, mostly <500μm wide, are common

Groundmass

c:f ratio – 1:1.5
c/f related distribution: fine monic - gefuric
Sand:silt:clay – 9:1:1

Mineral Component
Coarse material: 20-25%. Poorly sorted, tending towards a linear (horizontal) orientation
Predominantly quartz, limestone is frequent (3000-100μm)

- <2% fine gravel
- <2% very coarse sand
- 2-5% coarse sand
- 5-10% medium sand
- 5-10% fine sand

Fine material: 40-45%

- 5-10% very fine quartz sand, 50-100μm
- 20-25% micrite and microsparite (including ash)
- 2-5% silt
- 2-5% clay
- few faecal spherulites, 10-30μm

Colour: (XPL) greyish-yellow
(PPL) light grey
Limpidity: dirty/calcitic iron impregnated clay
b-fabric: microcrystallitic (calcitic)

Organic Matter: 10-15%

- common organic punctuations, <50μm
- few iron stained amorphous organic matter
- charcoal, <2mm, is frequent

Pedofeatures
Amorphous

- Sesquioxides increase from few to common down the layer, which becomes increasingly iron impregnated

Fabric

- *c.* 75% of charcoal and sand grains are horizontally oriented

Boundary: the boundary with the underlying remainder of soil, *c.* 0.5cm thick, is diffuse, distinct. This boundary is gradual, where fabric **c** is mixed up with the underlying loamy sand. The soil shows an increase in porosity (by *c.* 5%) and in coarse grains (by 5-10%). The charcoal in this soil is horizontally oriented, as are the few fragments of amorphous organic matter.

Sample: 18.12 **Contexts**: 18052/18053

General Observations
A large piece of limestone occupies almost the entire top half of this slide. The remainder is composed of the same loamy sand described in trench 1. Compared to (1185), this sample of soil is slightly more compact (20-25% porosity), and only very few vughs contain loose discontinuous infillings of fine groundmass material. No charcoal and anthropogenic inclusions were seen.