Assessment for Potential for Analysis of Soil Samples

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Author: Richard I Macphail

Museum of London Archaeology

Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
tel 0207 410 2200 fax 0207 410 2201 email mola@mola.org.uk

NO. 1. POULTRY, LONDON: ASSESSMENT FOR POTENTIAL FOR ANALYSIS OF SOIL SAMPLES

Richard I Macphail, Institute of Archaeology, UCL
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Introduction

The site of No. 1 Poultry was visited in 1996 (13-3-96), where it was discussed with Peter Rowsome (project director), and Dr. G. Wainwright and CAS personnel, who were also making a visit. A number of site areas and contexts were examined. For example, peat and brushwood layers, road sections, off-road channel fills and Boudiccan burned floors in Area 10, and Roman floors and associated hearth areas in Area 11, were photographed and recommendations for sampling, made. Subsequently, a large number sediment monoliths and Kubiena tins were taken, and deposits were described by Jane Corcoran. This present assessment is based upon this field visit, photographs, and an exhaustive number of section drawings, field descriptions, the list of research objectives listed prior to excavation and a preliminary excavation report, as supplied by MoLAS. The site has also been discussed at length with Jane Sidell (environmental manager, MoLAS).

The role of the soil study

Soil studies will be integrated into a multidisciplinary environmental investigation. Specifically, the more natural deposits will be studied alongside geoarchaeological logging, with sedimentary sequences also being broadly characterised by measurements of loss-on-ignition (organic matter) and magnetic susceptibility (qualitative MS)(Jane Sidell, personal communication, 1997). It is also quite clear from the sample list and section drawings that many sedimentary sequences will be studied through diatom (Nigel Cameron) and pollen (Rob Scaife) analysis. Here, soil studies will mainly play a minor complementary role, acting as a control. On the other hand, the identification of “palaeosols” will be a crucial part of the soil investigation.
Where sequences are dominated by occupation deposits, such as through floors and destruction levels, the soil study will be more closely linked to finds recovery, etc., playing an important auxiliary role in the identification of building use and area organisation.

Aims and objectives and associated samples

The pre-excavation research objectives led to a sampling strategy. There is a clear association between these objectives and the samples that have been collected for soil studies (Table 1), as follows,

6.1 Natural topography and environment,
Major role of the soil study What formation processes can be identified (6.1.1)? (e. g., samples 891, 896 and 1037)
Minor role of the soil study What was the nature of the Pre-Roman environment (6.1.2) and its topography (6.1.3)? (e.g., samples 429, 432, 437, 742, 897, 901)

6.2. Early Roman,
Major role of the soil study How did the area develop prior to the Boudiccan rebellion (6.2.5), what effect did the Boudiccan rebellion have on the area and what is the evidence of its recovery (6.2.8)? (e.g., samples 894, 907, 972 and 966);
What is the purpose of buildings (6.2.22) and can any spatial patterning be identified (6.2.23)? (e.g., samples 386, 468, 887, 905, 968, 973 and 994).
Minor role of the soil study Did site formation processes alter in relationship to the Walbrook (6.2.4)(e.g., sample 422, 891 and 967); what is the evidence for economic and dietary patterning (e.g., sample 386).

6.6 Medieval
Major role of the soil study What is the dominant formation process (6.6.3)? (e.g., samples 234 and 385).

Placing the proposed soil studies at No. 1 Poultry in context

Natural topography and environment.

The pre-Roman/early Roman brickearth soils (argillic brown earths) of the area have been studied (grain size, soil micromorphology, etc) from the Lloyds Merchant Bank (Macphail 1980), GYE/London Amphitheatre (Macphail and Cruise 1995) and Leadenhall St. (Macphail unpublished) sites. A thin section database of alluvium, prehistoric occupation soils and peats is also available from Bermondsey (Phoenix Wharf; e.g., Macphail *et al*. 1990; Merriman 1992). The methodologies for the study of ancient sediments and palaeosols are well-established in the literature (e.g., Wright 1986). More recently, taphonomic transformations of buried soils suffering increasing wetness or ageing/compaction/biological alteration, have been recorded from the Experimental Earthwork programme and from flood plain and coastal archaeological sites (e.g., Lewis *et al*. 1992; Macphail 1994b; Crowther *et al*. 1996). From such experiments and analogues it should be possible to accurately interpret natural site formation processes at Poultry.

Early Roman and Mid to Late Roman.
Roadside deposits of interest have been investigated, for example, from Deansway, Worcester and Scole, Suffolk (Macphail 1994; Macphail *et al*.), and currently drain fills are coming under study from the Watling St., at St. Albans (Museum extension site). In addition, early Roman waterlogged soils from nearby Cheapside have also been under scrutiny (Macphail unpublished). It is also possible that roadbed dumps and routeways trafficked by animals at No. 1 Poultry may have produced deposits that have dung-rich/stabling debris signatures, as found at Oakley, Suffolk, Elms Farm, Heybridge and Haynes Park, Bedfordshire (Macphail ; Macphail *et al*. ; Cruise and Macphail forthcoming/1997).
A basic database on earth (clay) and timber buildings and their clay floors was begun at the Courages Brewery site (Macphail 1994, 1996). The new St. Albans site also includes a series of clay floors in buildings fronting the Basilica, and these are to be studied. The investigation of floors and their deposits, has also provided clues on use. For example, at No. ? Bishopsgate, a microstratigraphic (soil micromorphology and chemistry) assessment has recently been undertaken (Macphail and Cruise 1997). Of particular note are two samples across a floor, the assessment of which found both chemical and soil micromorphological evidence of a byre. Such a finding not only has an experimental base (Butser Moel-y-gar stabling floor), but was predicted for Roman urban sites (Macphail 1994; Macphail and Goldberg 1995; Cruise and Macphail in press/1997).
The likely effects of the Boudiccan revolt and its aftermath have been found in Roman urban soils. At both nearby Whittington Ave., and at Culver St., Colchester, it seems plausible that soils containing large amounts of burned debris were cultivated for at least a short time after the rebellion (Crummy 1984; Brown 1988; Macphail 1994). Moreover, at Bishopsgate, Hadrianic fires have produced a whole series of destruction levels and deposits relating to their weathering, which have been assessed (Macphail and Cruise 1997).
As databases on the soil characteristics of Roman urban sites increase from the collection of building materials (clay walls, floors, mortars) and waste deposits, including all kinds of “dark soils” of Roman age, our reconstructions of landuse patterning are becoming more thorough. For example, not only are British Roman building materials (including Fishbourne) contributing to this database, but also materials from the Eastern Empire and mainland Italy (e.g., Blake 1947; Stoops 1984; Stoops and Stoops 1996; Macphail 1996). Roman urban sites have complex histories of landuse that include soil accumulations through building decay (e.g., Colchester House), ground raising through the laying of brickearth slabs and dumps (e.g., Bishopsgate, Whittington Ave.), in addition to the frequent re-laying of floors. At Pompeii, it has been recently found that during the last few centuries BC sloping ground from Mount Vesuvius was levelled with soil dumps, into which pits were dug before later buildings floors and gardens were constructed (Fulford etc). Preliminary chemical and soil micromorphological findings suggest that a whole variety of anthropogenic waste materials contribute to these soils, and also that soil studies can contribute to the understanding of use of rooms and their status (Crowther and Macphail 1997). Such studies in the use of urban space are well-established for Middle Eastern tell sites (e.g., Matthews and Postgate 1994).
The typical Roman London situation, where Late Roman masonry buildings were constructed in an urban landscape of waste ground of urban soils and decaying clay and timber buildings, have been met, at Southwark St., Southwark, GPO, St. Bartholomews, Bishopsgate, Winchester Palace and Colchester House. Mortar or tessellated floors may truncate or bury earlier soils or levelling, but surrounding soil deposits may reflect landuse contemporary with such structures. Often, however, both the masonry building and the contemporary soils are

"buried" by dark earth. Careful analysis, however, has been able to differentiate the dark earth components which are of Roman age from Saxon/medieval influences. For example, the evidence for Late Roman middening and probable animal pounding at Deansway, Worcester was quite different from the effects of Late Saxon (Burh) ash dumping and cess pitting (Macphail 1994). In the same way, medieval-post medieval influences on dark earth soils, through the dumping of cess and charcoal and slag-rich wastes have been quite clearly recognised at Courages Brewery and at Bishopsgate. In the same way, mature dark earth soils formed in the London Arena during the period AD *c*. 400-1000 were markedly affected by new Saxo-Norman activities that may have included animal pounding prior to clay and wattle constructions (Macphail and Cruise 1995).

Medieval
The intensively occupied Saxo-Danish settlement at GYE is being assessed (Macphail and Cruise 1995). Different constructional materials (brickearth clay, dung, turf, etc.), and different areas of animal stabling and domestic occupation have been recognised. These results in part relate experimental data from microstratigraphic investigations (e.g., soil micromorphology and chemistry) of the Moel-y-gar stabling house floor and the domestic Pimperne house floor at Butser Ancient Farm, Hampshire (Macphail and Goldberg 1995, Plates 3-6, Figure 2; Cruise and Macphail in press/1997; Macphail *et al*. in press/1997). These studies, which were in part funded by the British Academy, also have an international element through ongoing research into Swedish experimental turf structures (Macphail 1996; Cruise and Macphail in press/1997). This research has now been expanded into the study of floors from two examples of tripartite divided long house from southern Sweden that date to the pre-Viking era (sampled in 1996). Although Middle Saxon long house deposits were not preserved at the West Heslerton (N. Yorks.) settlement, very many occupational deposits are being studied from an extensive "farm mound" and numerous *Grubenhäuser* (Powlesland 1996). The English Heritage funded post-excavation soil study of the prehistoric, Roman and Saxon sediments commences in September 1997, and as the assessment showed, is likely to be able to differentiate deposits of domestic, stabling and industrial origin. There is therefore every confidence that the proposed investigation of Saxon floor deposits at Poultry will be successful, because it is being carried out in the context of an expanding multidisciplinary experimental and archaeological database.

Summary Statement of Potential
Quality of the samples: As far as can be judged from the field visit, the quality of the sample description and sediment recording, the number and location of the samples should permit the attainment of the aims and objectives as outlined for the role of the soil study (see above). The monolith and Kubiena box samples can be described, photographed and subsampled for chemical analysis of bulk samples from specific layers/contexts, before resin embedding of soil for soil micromorphological studies (see methods below).

Potential for data retrieval: The role of the soil studies in the investigation of site formation processes for both the natural site and the anthropogenic contexts was described above. There are many published articles, numerous unpublished reports (including many commissioned by MoLAS) and a very large number of experiments and current archaeological site studies of absolute relevance to the suggested soil investigation at Poultry. All these show the potential for analysis at Poultry. Recent combined soil micromorphological and chemical studies of similar site situations further indicate the good potential for data retrieval.

Research Programme: Methods, Collaboration and Costs
Methods
The two techniques applied to this microstratigraphic study are soil micromorphological and chemical analyses.

Numerical soil micromorphological analysis: Thin sections can be studied at two levels. Often soil micromorphological description provides sufficient data to allow an interpretation of a past soil's history. On the other hand, description can be followed by numerical analysis of the described features and components, if a vertical stratigraphy needs to be defined to lend scientific weight to an interpretation. Such microstratigraphic analyses can also be linked to chemistry to provide combined signature analysis.

Details of the numerical method and its rationale are described in Cruise and Macphail (in press/1997; in preparation). In brief, it has been found that numerical soil micromorphological analysis can be highly productive when applied to the study of superficially homogenous deposits, or when a succession of key micro-layers need to be defined. It is based upon the methodology developed during the 1992 study of the Overton Down Experimental Earthwork (Macphail and Cruise 1996; Crowther *et al*. 1996). This approach to the study of soil thin sections has also been successfully applied to the poorly stratified LBA/EIA deposit at Potterne, Wiltshire, experimental floors at Butser Ancient Farm and to an experimental turf roof in Sweden (Macphail 1996a, 1996b; Cruise and Macphail in press/1997, in preparation). Of specific relevance, the deposits at Colchester House and 2-11, Bishopsgate have recently undergone the most detailed microstratigraphic investigation yet carried out on urban sediments in the UK (Macphail and Cruise 1997). This included the vertical characterisation of Roman dark soils formed from decayed clay and timber buildings, a series of Hadrianic destruction levels and their associated floor sediments, masonry buildings and their environs, and the succeeding dark earth deposits. A notable discovery was a burned, probable byre floor, sampled from two locations at Bishopsgate, that had the same chemical (see below) and key soil micromorphological features as detailed from the experimental stabling floor at Butser.

At Poultry the first step would be to identify, building materials employed in Roman London (e.g. clay floors, walls, mortar, plaster), components of occupation soils or dark earth-like deposits, as defined in previous studies (e.g. Macphail 1994, 1996a, Macphail *et al*. 1997) and major pedological features. They would be individually counted for every 1 x 1 cm square of each thin section.

At Poultry, thin section samples would be selected for semi-numerical study or be interpreted simply from soil micromorphological descriptions. As no thin sections were processed for this assessment, it can be suggested here that only the anthropogenic deposits be investigated by the greater precision of semi-numerical analysis. This is because the more natural deposits are likely to have a greater level of homogeneity.

Chemical analyses In past studies local London river sands, natural brickearth, related building clay and the dark earth itself, have all undergone numerous chemical and physical assays (Macphail 1981, 1994, 1996a; Macphail and Courty 1984). For example, spot phosphate tests, organic carbon, nitrogen, loss-on-ignition (LOI), calcium carbonate, cations (Ca, Mg, Na and K) and grain size, have been measured. The deposits at Poultry will also be undergoing logging by general loss-on-ignition measurements and qualitative magnetic susceptibility studies. They have already logged geomorphologically.

Recently, a different suite of analyses have been employed to augment soil micromorphological data because they have been found to produce archaeologically-relevant data (Engelmark and Linderholm 1996; and Macphail *et al*. in press/1997). For example, selected samples from Romano-British and Roman dark earth from four small town sites and from the London Southwark site of Courages Brewery, have all been tested to establish a basic database (Macphail 1996a, Macphail *et al*. 1997/in press). The assessments of Colchester House and Bishopsgate have added further to this database. Experimental soils and occupation deposits have also been included in a number of pilot studies that have been combined with soil microstratigraphic analyses. Measurements are made of LOI (organic matter), magnetic susceptibility (MS), MS after ignition at 550ºC, 2% soluble citric acid soluble phosphate (Pº) and phosphate after ignition at 550ºC (Ptot). All the techniques employed are well-established (e.g. Arrhenius 1934, 1955) and it is only the combined use of such which is novel.

Collaboration

The study of the anthropogenic deposits at Poultry will not only be carried out in the context of major funded post-excavation soil studies at West Heslerton, but will be integrated into current research at Fishbourne Roman Palace and Pompeii. Other current projects of relevance, which are at the assessment stage, are at GYE, Bath and St.Albans. European colleagues from the International Working Group on Archaeological Soil Micromorphology are also producing data on Roman building materials from as far afield as the near east (e.g., Stoops). Soil studies were an important part of the investigations of the Carrousel Gardens,

Louvre and Collège de France sites in Paris, the author being consulted in both cases (e.g., Ciezar et al 1994; Cammas et al 1996). The sequence at the Collège de France site and other examples of French and UK dark earth sites were discussed by the Working group with author's abstracts, to be published on the Internet. There has been scientific collaboration with a Swedish team (chemistry, insects and plant macrofossils) at Umeå University (Roger Engelmark and Jöhan Linderholm) on experiments (turf roofed structures, cultivation) and Swedish long house settlements since 1992. They have contributed chemical analyses and expertise to augment British soil studies on Roman town (Bishopsgate, Colchester House, Courages, Deansway, Elms Farm, Scole), Roman rural (Haynes Park, Oakley, Scole, Warren Villas, West Heslerton), Saxon (West Heslerton) and Saxo-Danish (GYE) sites (e.g., Engelmark and Linderholm 1996; Macphail *et al*. 1996a, 1996b, 1997/in press).
Thus the proposed soil investigations at Poultry, would be undertaken in the context of European collaboration, within an expanding UK and Europe-wide database. Specifically, the soil micromorphological studies would be augmented by chemical analyses carried out by the Swedish team, interpretations thus being a collaborative exercise. This has proved highly successful during the analysis stage at Scole and Oakley (Macphail *et al*. 1996a and 1996b).

Samples and Costs
The number of samples chosen for analysis is listed in Table 2. 37 Kubiena tins have been selected from a potential total of 57. Of these, 25 have been selected for full semi-numerical microstratigraphical analysis and 11 for soil micromorphological description only. It is suggested that the soil micromorphological study should be augmented by 61 chemical analyses. As the samples were not taken by the author, it is important that time is put aside to examine the Kubiena tin samples and monoliths properly, and this may involve description and photography. This can be carried out when subsampling for bulk chemical analyses.

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Table 1: No. One Poultry; Soil Micromorphology Chart

Sample No.	No. Tins	Area	Section	Date	Unit Type	Research Type	Associated Monos
234	4	9		Late Saxon/Med	Occupation	Building use	No
385	1	8		Late Saxon/Med	Occupation	Building use	No
386	1	8		Roman	Dense organics	?Dung	No
422	3	9	36	Roman?	Sediment sequence	Site formation processes	No
432	3	9	33	Roman	Sediment Sequence	Site formation processes	Yes - 2 (1+2?)
437	4	9	35	Roman	Sediment Sequence	Site formation processes	Yes - 1 (429)
468	1	8		Roman	Occupation	?internal/external+use	No
887	1	O+R		Early Roman	Occupation	Use of Area	No
891	2	10	72	Early Roman	Sediment Sequence	Site formation processes	Yes - 1 (890)
894	2	10	77	Early Roman	Burnt Daub	Post-destruction processes	No
896	2	10	78	Early Roman	Sediment Sequence	Site formation processes	Yes - (895)
897	7	10	72	Early Roman	Sediment Sequence	Site formation processes	Yes - 2 (898 a+b)
901	3	10	70	Early Roman	Sediment Sequence	Site formation processes	Yes - 1 (900)
905	1	10	75	Early Roman	Burnt wood+sediment	Roadside activities	No
907	1	10	75	Early Roman	Organic spread	Is it same as material to the south of the road gravels	Yes - 1 (908)
966	1	11	82	Boudiccan	Abandonment unit	To confirm	No
967	3	11	85	Early Roman	Occupation	Land use	No
968	7	11	84	Early Roman	Occupation	Building use	No
972	1	11	74	Boudiccan	Abandonment unit	To confirm	No
973	5	11	83	Early Roman	Occupation	Land use	yes - 1 (974)
994	1	12	98	Roman	Occupation?	To confirm	yes - 2 (995+1020)
1016	1	12		Roman	Fill of wooden tank	deliberate/natural	No
1037	2	12	98	Early Roman	Sediment sequence	Site formation processes	yes - 1 (1036)

N.B - Some samples are not included on this table which we talked about the other day - on closer inspection, they seem to be monolith tins, not ‘kubiena’ tins

Table 2: No. One Poultry; Proposed Soil Micromorphology and Chemical Study (Methods to be applied)

Sample No.	No. Tins to be studied	Method	No. Chemical samples	Date	Unit Type	Research Objective	Associated Monos
234	4 of 4	Strat.	8	Late Saxon/Med	Occupation	E. Med. Building use	No
385	1 of 1	Strat.	2	Late Saxon/Med	Occupation	E. Med. Building use	No
386	1 of 1	Strat.	2	Roman	Dense organics	Roman landuse	No
422	1 of 3	Desc.	1	Roman?	Sediment sequence	Walbrook	No
432	1 of 3	Desc.	1	Roman	Sediment Sequence	Pre-Roman environment	Yes - 2 (1+2?)
437	1 of 4	Desc.	1	Roman	Sediment Sequence	Pre-Roman environment	Yes - 1 (429)
468	1 of 1	Strat.	2	Roman	Occupation	?internal/external+use	No
887	1 of 1	Strat.	2	Early Roman	Occupation	Use of Area	No
891	1 of 2	Desc.	1	Early Roman	Sediment Sequence	Site formation processes	Yes - 1 (890)
894	2 of 2	Strat.	4	Early Roman	Burnt Daub	Boudiccan post-destruction processes	No
896	1 of 2	Desc.	1	Early Roman	Sediment Sequence	Site formation processes	Yes - (895)
897	2 of 7	Desc.	1	Early Roman	Sediment Sequence	Pre-Roman environment	Yes - 2 (898 a+b)
901	1 of 3	Desc.	1	Early Roman	Sediment Sequence	Pre-Roman environment	Yes - 1 (900)
905	1 of 1	Desc.	1	Early Roman	Burnt wood+sediment	Roadside actvities	No
907	1 of 1	Desc.	1	Early Roman	Organic spread	Is it same as material to the south of the road gravels	Yes - 1 (908)
966	1 of 1	Strat.	2	Boudiccan	Abandonment unit	Boudiccan post-destruction processes	No
967	1 of 3	Desc.	1	Early Roman	Occupation	Walbrook	No
968	7 of 7	Strat.	14	Early Roman	Occupation	Building use	No
972	1 of 1	Strat.	2	Boudiccan	Abandonment unit	Boudiccan post-destruction processes	No
973	5 of 5	Strat.	10	Early Roman	Occupation	Land use	yes - 1 (974)
994	1 of 1	Strat.	2	Roman	Occupation?	Building use	yes - 2 (995+1020)
1016	0 of 1		0	Roman	Fill of wooden tank	deliberate/natural	No
1037	1 of 2	Desc.	1	Early Roman	Sediment sequence	Site formation processes	yes - 1 (1036)
Total	**37 of 57**	**25 Strat. 11 Desc.**	**61**				

Key: Micromorphological methods - Desc. (description), Strat. (semi-numerical analysis of microstratigraphy)