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Waste disposal in late Iron Age and early Roman Silchester: A geochemical comparison of pits, post holes, ditches and wells in Insula IX

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ABSTRACT

Bulk chemical analysis was undertaken on samples taken from 143 negative features (wells, pits, post-holes, cess pits and ditches) across the area of excavation at Silchester Hampshire in order to help us understand the disposal of waste during late Iron Age and earliest Roman occupation. Results show that it is possible to split features into waste disposal which included animal/human waste and those which probably did not. It is also possible to identify post-holes based on organic matter content. This work forms part of the larger Town Life project run by the University of Reading.

1. Introduction

Since 2002 a sampling strategy using bulk geochemical analysis (X-ray fluorescence) has been developed in the context of the Silchester Roman Town Life Project in Insula IX, where excavation by the Department of Archaeology at the University of Reading began in 1997 and was concluded in 2014. The aim of the strategy has been to enhance our knowledge of the changing use of space and of occupational behaviour within the area under investigation, some 3025 m^2, which represents about one quarter of this entire block (*insula*) of the Roman town. Using XRF as the principal technique of investigation, research initially focused on the interior of one mid-Roman house (House 1) (Cook et al., 2005, 2014), then on the wider use of hearths across the excavated area (Cook et al., 2010) and, more recently, on the differential use of space of the timber-framed buildings occupying the area under excavation in the late 1st and early 2nd century AD (Period 2) (Cook et al., 2014).

As the excavation reached the earliest occupation layers, representing the initial settlement of the late Iron Age from *c*. 20 BCE (Period 0) and the earliest post-Roman conquest phase from the mid-40s to the last quarter of the 1st century AD (Period 1), a much greater density of pitting and well digging was found than in subsequent phases. It is generally assumed that the pits, even if originally dug in order to extract water or building materials such as gravel or clay, were eventually used to receive waste of all kinds. Even wells, once abandoned as a source of water, were used in a similar way. Typically such features contain quantities of discarded pottery, ceramic building material and animal bone as well as the macroscopic waste from metalworking. There are also the rarer, items of material culture like metalwork, including items such as coins and personal items. Programmes of environmental sampling use flotation to recover the carbonised remains of seeds and wood charcoal, while the residues from these processes produce finds not usually recovered in hand excavation such as small mammal and fish bone, mineralised seed and plant remains and the microscopic remains of metalworking. Waterlogged contexts producing well preserved seed and plant remains, as well as perishable materials such as leather, textiles and wood give an indication of the range of organic materials which do not normally survive.

The geochemistry of the soils reported here is designed to complement the comparative analysis of the contents of pits and wells based largely on the macroscopic finds of material culture and faunal remains and to investigate potential patterning that will shed light on variations in occupational behaviour across the excavated area. It will also help moderate initial interpretations made in the field, for example that certain pits were used for cess disposal. Underlying the approach is an assumption that the pits and wells will produce a distinctive geochemistry. In order to test this, the study has been broadened to include samples from ditches, gullies and post-holes. The latter, for example, are generally interpreted as such on the basis of their size, but the geochemistry may help to distinguish small pits actually used for waste disposal and holes dug to take the structural components of buildings.

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2. Methods

Samples were taken from negative features across the excavation at Silchester Insula IX, these features were characterised during the excavation as pits (sixty-four features), ditches/gullies (nineteen features) post-holes (sixty features) and wells (three features). The features were classified as follows:

Pits: features excavated for a variety of purposes such as storage and disposal of human and animal waste. Ditch/gully: features which have been used for drainage, either for roads or buildings, enclosures or defences.

Posthole: features used to hold posts, either for a fence or building.

Well: a feature used to draw drinking water for human and/or animal consumption.

The samples were allowed to dry, then dis-aggregated and passed through a 1 mm sieve. The number of sample analysed necessitated a technique that was both rapid and relatively low cost, in this case X-ray fluorescence was chosen. The samples were then ground and pressed into pellets with a KBr backing for analysis by X-ray fluorescence (XRF) using a Philips PW1480 XRF with Philips × 40 analytical software. Analytical quality was determined by running multiple sub-samples and certified reference material was used to check the accuracy of analysis. Organic matter content of selected samples was determined using loss-on-ignition at 500 °C.

The bulk (the XRF analysis providing total element concentrations) geochemistry of the samples has then been compared both against each other and against background soil samples collected from outside the Roman town wall at Silchester, The aim of the work is to examine variability and elucidate any differences which may enhance the interpretation of individual features and, more generally, of occupational behaviours across the excavated area in the late Iron Age and earliest Roman period.

3. Results

In order to begin to understand the chemical fingerprints of each type of feature the average concentrations of both major and trace elements were first considered in relation to the mean background concentrations (Table 1a), these were then plotted to obtain an “average chemical fingerprint” for each feature type (Fig. 2). At first glance there are six elements which appear enriched within the samples from the anthropogenic features; these are copper, zinc, strontium, phosphorus, calcium and manganese.

Copper and zinc are found at highest concentrations in the cess and rubbish pit samples. The samples from these features contained greater amounts of organic matter (Table 1b) than the well samples but less than the post-hole samples. Unsurprisingly given its affinity for organic matter Cu has the largest correlation with organic matter content (0.46). The explanation for the high organic matter but lower copper concentration in the post holes may be due to the nature of the infilling and/or decay of the posts *in-situ*, particularly if the post was charred, examples of charred posts were found in the forum basilica excavations (Fulford and Timby, 2000, 29). Pit 12,462 was the only feature analysed that was interpreted during excavation as a cess pit. However the chemical signal from the samples analysed (Table 1, Fig. 2) demonstrates that this feature, while contained elevated P concentrations, is not markedly different from the chemical signature obtained from the pits. Cess and rubbish pits contain a variety of human and animal waste which is likely to be higher in Cu (Oonk et al., 2009a, 2009b), whereas the material from the postholes is more likely to be packing for the post (rubble, soil) and soil infill into the void left by the decayed post. Zinc is also found in highest concentrations in the rubbish pits, in all probability for the same reason as Cu.

Strontium is also indicative of anthropogenic activity and has been shown to be associated with food preparation, animal penning and burning (Middleton, 2004). The highest concentrations of Sr were

Table 1a
Average major and trace elemental concentrations found in samples from different negative features and background soils. Silchester Insula IX.

Values in mg/kg dry weight	V	Cr	Co	Ni	Cu	Zn	Rb	Sr	Y	Zr	Pb	Na	Mg	Al	Si	P	K	Ca	Ti	Mn	Fe
Well/cess	26.38	52.82	7.21	11.00	**32.86**	**74.79**	59.33	**96.11**	13.29	295.7	46.06	684	1998	40109	388374	**4327**	9234	**11883**	2764	**949**	17372
Well	19.90	49.70	4.93	7.43	**21.70**	**48.00**	52.43	**82.83**	12.37	299.3	24.07	653	1474	35023	393360	**3056**	8276	**15866**	2688	**483**	13642
Cess	32.69	55.69	9.20	14.14	**42.29**	**98.31**	65.71	**108.34**	14.17	290.8	**65.29**	710	2481	44837	383782	**5449**	10130	**8660**	2830	**1342**	20770
Pits	32.61	57.76	9.71	12.74	**46.46**	**99.47**	65.33	**128.60**	13.89	339.4	40.65	961	2168	38526	386016	**6378**	10329	**10089**	3131	**1384**	20378
Post hole	21.99	48.85	6.90	9.06	**34.32**	**64.94**	58.62	**90.68**	11.63	324.4	35.15	883	1526	34607	394201	**4056**	8722	**7118**	2941	**728**	16414
Ditch/gully	21.46	44.86	7.21	9.46	**33.06**	**74.13**	56.17	**88.84**	11.56	267.5	38.59	704	1420	33066	400954	**4694**	7884	**6504**	2494	**972**	17015
Background samples																					
Bagshot Beds	65.00	70.00	4.50	8.50	7.00	23.75	64.50	42.75	17.00	461.8	25.75	1243	2337	38895	402285	371	14983	644	3537	173	15570
Silchester gravels	37.00	47.00	5.00	6.00	18.00	39.00	45.00	31.00	15.00	417.0	43.00	1187	241	17669	433810	1135	7056	429	3297	462	8598
London Clay	77.67	86.00	14.67	21.00	11.00	41.67	71.00	56.67	25.33	502.3	19.33	1632	4282	45653	367963	655	15523	2288	4077	231	39773
MEAN background	**59.89**	**67.67**	**8.06**	**11.83**	**12.00**	**34.81**	**60.17**	**43.47**	**19.11**	**460.4**	**29.36**	**1354**	**2287**	**34072**	**401353**	**720**	**12521**	**1120**	**3637**	**289**	**21314**

Figures in bold represent those above average background concentration with those underlined being below average background concentration.