SUPPLEMENTARY MATERIAL

To be read in conjunction with

Thomas, G et al 2023. In The Shadow of Saints: The Long Durée of Lyminge, Kent, as a Sacred Christian Landscape, *Archaeologia* 112

This supplementary material provides specialist reports on a range of analyses supporting interpretations and conclusions in the main article. These include the following:

OSL DATING OF BUILDING MORTAR SAMPLES FROM LYMINGE

Ian Bailiff and Eric Andrieux

SUMMARY OF DATING RESULTS

Site Ref	Sample Label	Context	OSL Date[1] CE±□	OSL Date Ref
Lym 19 Sample 1	(42) <1>	Foundation, C7th church (apse)	730±110	Dur447–1SGqi
Lym 19 Sample 2	<3>	Foundation, C7th church (crossing)	630±105	Dur447–2SGqi
Lym 19 Sample 9	<9>	SE corner chancel of extant church (C10/C11?)	1040±70	Dur447–3SGqi
Lym 19 Sample 14	(8) <14>	Foundation to west of Period 1 (C7th) church	1175±70	Dur447–4SGqi
(1)	(2)	(3)	(4)	(5)

1. The overall error is calculated at the 68 per cent level of confidence

COMMENTS AND OBSERVATIONS

1. OSL date calculation
The OSL dates given in the table have been calculated using data given in the Technical Summary below. The summary provides details of the various experimental measurements performed and the data obtained, together with a breakdown of quantities determined to evaluate the OSL age calculation based on measurements with granular quartz extracted from the mortar.

2. Effect of heterogeneity in mortar composition on OSL date calculation
As discussed in the Technical Summary, the presence of cobble-sized clasts of flint within the mortar (as illustrated in the Technical Summary) affects an assessment of the dose rate to quartz grains arising from the heterogeneity of the mortar, in particular the presence of flint cobbles in Samples 1 and 2. Generally, the flint has a much lower radioactivity than the mortar matrix, reducing the dose rate. In the case of Samples 1 and 2, the composition of the mortar sample supplied was assumed to be representative of the mortar medium extending to distances of ca 30cm from the sampled volumes from which the gamma radiation component of the dose rate is derived. It was also necessary to make assumptions regarding the composition of the extended volume surrounding the sampled mortar fragment in the case of the other locations.

3. Characteristics of quartz grains extracted for OSL measurements
The OSL measurements performed with individual quartz grains extracted from the mortar samples indicated that in most cases the ‘resetting’ of the luminescence clock mechanism had been relatively effective, and significantly better than reported in some earlier reports on testing mortar from medieval structures. This may have resulted from the way in which sand had been treated before incorporation in the mortar mix, giving rise to disaggregation and thorough exposure to daylight, or that the granular quartz had been derived from a sand bearing carbonate used in the slaking process (and consequently heated). However, the yield of ‘bright’ grains suitable for use in the age calculation was very low (ca <1%) requiring significant instrument time to identify suitable grains.

TECHNICAL SUMMARY

1. Samples of mortar supplied for OSL testing had been extracted from larger volumes excavated within the four contexts indicated in Table 1 and Fig 1a–g. The mortar is generally coarse, containing a heterogeneous mixture of flint gravel, with flint cobble present in the case of samples 1 and 2.

2. Material for OSL sample preparation was extracted from the inner volume of the mortar samples under subdued red light after removal of an outer layer of at least 10mm. This inner material was mechanically disaggregated and the sand-size fraction selected and sieved to obtain the 150–250μm fraction. Prolonged immersion of the sieved fraction in dilute HCl was applied to remove carbonate minerals, and subsequently the treated material was immersed in HF (40 per cent, 45 mins) to isolate the quartz fraction and remove the outer layer of quartz grains, following the conventional quartz inclusion technique. The resulting fraction was subjected to a final treatment of immersion in HCl (40 per cent) for 1h to remove any precipitated fluorides resulting from the HF etching procedure. Following washing and drying procedures, the HF etched grains were sieved to remove grains smaller than 150μm diameter.

3. The single aliquot regeneration (SAR) procedure was followed, employing a single grain measurement procedure to determine the equivalent dose, D_e. A single preheat temperature was selected on the basis of the completion of a dose recovery experiment (Table 2a, col. 3); this was applied in the SAR procedure to determine D_e values for individual grains passing the standard rejection criteria. The rejection criteria included: 1) signal intensity; the natural signal from the aliquot/grain not distinguished from the background signal (determined using the Luminescence Analyst 'sig. >3 sigma above BG' rejection criterion), 2) recycling; the recycling ratio differed from unity by >20 per cent; 3) recuperation; the sensitivity-corrected zero dose luminescence intensity was >5 per cent of the natural luminescence intensity; 4) Infrared depletion; the IR-depletion ratio exceeded two standard errors below unity; 5) D_e uncertainty; the uncertainty in D_e exceeded 30 per cent; 6) saturation; the natural luminescence signal (Ln/Tn) intercepted the dose response curve at a point where signal growth had ceased and 7) Zero D_e; where D_e was consistent with zero at two standard errors (added to exclude modern grains, or fully bleached grains, incorporated during sampling).

An example of a typical dose response curve is shown for each OSL sample in Figure 3. Generally, the frequency of bright grains was very low, requiring the testing of several thousand individual grains for each sample to produce a sufficient number of accepted D_e values (Table 2a, cols 4 and 5). The accepted values of D_e (± s.e.) obtained are listed for each sample in Table 2a (col. 7). The form of distribution of the D_e values for each sample and the extent of departure from a normal distribution are shown as Q-Q plots in Figure 2.

The central dose model (CDM) was initially applied to analyse the distribution of D_e values for each sample and to evaluate the degree of overdispersion (OD, Table 2a, col. 6,). On the basis of inspection of the Q-Q plots and assessment of the distributions shown in the Abanico plots (Fig 2a, c, e, g), the CDM model was applied to determine a weighted average value of D_e in the case of three samples (Samples 447 -1, -2, -3; Table 2a, col. 7). Although the degree of the skewness (c; Table 2d, col. 2) is significant in two cases (447 -2 and -3), this was negated by the removal of 1 or 2 outliers (Table 2d, cols 3 and 4). In the case of sample 447–4, the Q-Q plot contains two distinct components reflecting the presence of a 'minimum' dose component; removal of the D_e values forming the component in the higher dose region results in the reduction of the skewness present with the full set of data. Hence the minimum dose model (MDM) was judged to be appropriate to apply to the D_e distribution obtained with this sample.

4. The average annual dose rate to each extracted quartz sample, $\dot{D}_{tot}$, was assessed on the basis of the measurement of the radionuclide concentration in disaggregated sub-samples (25g) of the mortar fragments and also separated lithic clasts within them (flint and pebbles). The concentrations of the parent ^{238}U, ^{232}Th

and ^{40}K and their progeny were determined by measuring the gamma-ray spectrum using a high-resolution gamma ray spectrometer. The measured specific activities of the radioisotopes (Table 2b) were converted to infinite medium dose rates using our own conversion factors which are similar to published values (Guerin *et al* 2011). With the exception of the flint sample extracted from mortar sample 447–2, the values of the $^{226}Ra/^{210}Pb$ ratio do not indicate significant disequilibrium in the uranium chain. Adjustment of the dose rate for the moisture content of the burial medium was made (Aitken 1985) assuming an average value during burial of 10±2 per cent by weight.

As can be seen in Fig 1 (b, c, e, g), the mortar fragments contain a heterogeneous mixture of clasts, including sand, pebbles and flint cobbles. These constituents formed a well-bonded and very strong mortar. While the volumes of mortar extracted for OSL measurements were selected to avoid direct contact with the larger lithic clasts (eg, as in the case of 447 -1 and -2, for example), the mortar collected from all four locations contained a high proportion of gravel. A potential issue arises in the assessment of beta dose rate (and as a consequence the cumulative dose accrued during burial, D_e) where individual grains were: a) enclosed within the finer fraction of the mortar material and b) in direct contact with the surface of a lithic clast which typically has a lower concentration of lithogenic radionuclides compared with mortar (Table 2b). There is a similar issue in the assessment of the gamma dose rate, but on a larger physical scale. Flint cobbles located within a volume of material (referred to here as the 'gamma' volume) that extends to ca 30cm from the OSL sample 'dilute' the gamma dose rate, the extent depending on their concentration and distribution in that volume. In the absence of in situ measurement of the dose rate at the OSL sample location, assumptions relating to the composition of the material within the gamma volume are necessary leading to some approximations, as outlined below.

Dur447-1 (Lym 19 — Sample 1). To account for the flint cobble present in the mortar it has been assumed when calculating the gamma dose rate that flint accounts for 50 per cent of the gamma volume by weight. In addition, to account for a concentration of ceramic material within the gamma volume that is lower than that observed in the mortar fragment, the gamma dose rate was calculated based on the measured radionuclide concentration for a mortar sample where ceramic fragments had been removed.

Dur447-2 (Lym 19 — Sample 2). The proportion of flint in the gamma volume is the same as that assumed for Location 1.

Dur447-3 (Lym 19 — Sample 9). The mortar sample was extracted from a depth of 5–10cm into the masonry wall; no sample representative of the ragstone was available. The ca 10 per cent reduction in dose rate due to proximity to the wall surface (eg, 10cm) was assumed to be compensated by gamma radiation from lithogenic radionuclides in the ground. In the absence of samples of the latter, or in situ measurements of the gamma activity/dose rate, the gamma dose rate was calculated as the infinite medium dose rate based on the analysis of the mortar sample.

Dur447-4 (Lym19 — Sample 14). The image of the sample location indicates a heterogeneous mortar containing gravel and cobbles. The gamma dose rate was calculated assuming an infinite medium defined by the mortar matrix where flint accounted for 50 per cent of the gamma volume by weight, as for Samples 1 and 2.

5. The OSL ages, listed in Table 2c (col. 6) were calculated as the quotient of the equivalent dose, D_e, and the total dose rate, $\dot{D}_{tot}$; the OSL age test year was CE 2021. All uncertainties are given at the 68per cent level of confidence (1σ); the overall error associated with the OSL age ($\square_O$, col. 8) includes an assessment of type A ($\square_A$, col. 7) and type B errors combined in quadrature. The OSL dates shown in col.7, expressed on the Common Era timescale, have been rounded to the nearest five years.

Lab Ref Dur447-	**Site Ref**	**Sample Label**	**Context**
1	Lym 19 Sample 1	(42) <1>	Foundation, C7th church (apse)
2	Lym 19 Sample 2	<3>	Foundation, C7th church (crossing)
3	Lym 19 Sample 9	<9>	SE corner chancel of extant church (C10/C11?)
4	Lym 19 Sample 14	(8) <14>	Foundation hypothetical successor to Period 1 (C7th) church
(1)	(2)	(3)	(4)

Table 1

Date Ref. Dur447-	PreHt Temp (°C)	DoseRec D_e/D_a	SGr n tested	SGr n accepted	OD %	D_e (Gy)	Dose Model
1	200	N/A	6000	33	33	1.44±0.07	CDM
2	200	N/A	6000	50	26	1.40±0.07	CDM
3	200	N/A	6000	32	22	0.91±0.05	CDM
4	200	1.1 ± 0.09	9000	30	33	0.97±0.07	CDM
						0.81±0.05	MDM
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Table 2a

Date Ref. Dur447-		Type	Specific activities ^{232}Th (Bq kg^{-1})	^{238}U	^{40}K	$^{226}Ra/^{210}Pb$
1		mortar	14.1±2.7	14.3±1.5	229±5	0.88±0.19
		gravel	8.0±2.6	10.4±1.5	160±5	0.79±0.30
2		mortar	10.6±1.9	13.1±1.1	180±3	0.84±0.14
		flint	2.2±1.7	3.8±1.0	60±3	0.47±0.44
3		mortar	7.0±2.5	8.2±1.5	152±5	0.86±0.32
4		mortar	10.0±2.7	16.6±1.6	150±5	0.88±0.17
(1)		(2)	(3)	(4)	(5)	(6)

Table 2b

Date Ref.	$\dot{D}_{□\&i}$/ $\dot{D}_{□□□}$□	$\dot{D}_{□\&ic}$/ $\dot{D}_{□□□}$	$\dot{D}_{□□□}$	D_e	Age (±1□$_r$)	Uncertainty		Date
Dur447-	%	%	mGy a^{-1}	Gy	a	±□$_A$	±□$_O$	CE±□
1	64	36	1.12±0.02	1.44±0.07	1294	88	112	730±110
2	59	41	1.00±0.02	1.40±0.07	1394	76	103	630±105
3	51	49	0.93±0.02	0.91±0.05	981	52	69	1040±70
4	58	42	0.96±0.02	0.81±0.05	847	55	69	1175±70
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(7)

Table 2c

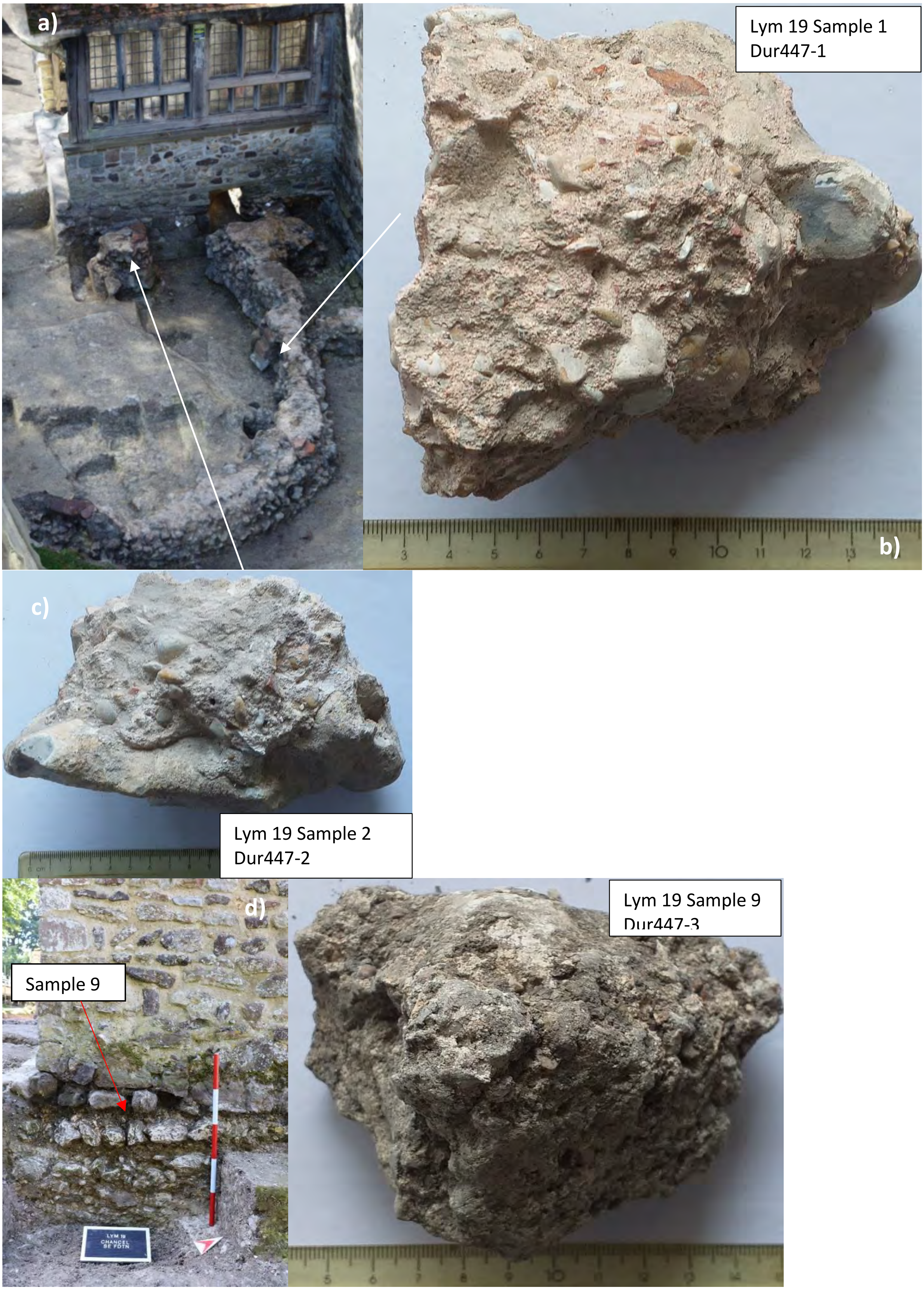
Date Ref. Dur447-	**Skewness c n=33**	**Skewness c**	**Sensitivity**
1 SGqi	0.65(75%)	-	
2 SGqi	1.08(155%)	-0.58(-83%)	Removal of 2 highest D_e values
3 SGqi	2.63(300%)	-0.22(-25%)	Removal of highest D_e value
4 SGqi	1.24(140%)	0.19(18%)	Removal of 7 highest D_e values
(1)	(2)	(3)	(4)

Table 2d

447-1		447-2		447-3		447-4	
D_e (Gy)	s.e.	D_e(Gy)	s.e.	D_e(Gy)	s.e.	D_e(Gy)	s.e.
1.01	0.09	1.08	0.57	0.99	0.30	0.78	0.10
1.14	0.38	1.55	0.28	3.21	0.62	0.77	0.08
2.47	0.45	1.22	0.44	0.69	0.25	1.64	0.32
1.17	0.19	1.08	0.21	0.80	0.14	1.22	0.49
1.18	0.20	1.03	0.57	0.92	0.25	2.43	0.20
1.45	0.30	1.53	0.41	1.25	0.48	0.89	0.27
1.26	0.17	1.26	0.43	0.77	0.24	0.81	0.44
0.73	0.44	1.88	0.54	0.80	0.04	0.78	0.09
1.66	0.19	0.94	0.48	0.61	0.04	0.84	0.10
3.55	0.58	1.60	0.51	1.11	0.08	0.70	0.07
1.40	0.37	1.50	0.75	1.09	0.19	1.61	0.32
0.85	0.09	1.24	0.48	0.91	0.19	1.37	0.47
1.03	0.14	1.25	0.47	0.91	0.30	2.09	0.20
1.52	0.37	0.98	0.68	0.87	0.11	0.84	0.25
1.15	0.22	1.58	0.23	1.00	0.30	0.86	0.45
2.59	0.92	1.13	0.38	0.67	0.08	0.96	0.20
1.55	0.47	1.74	0.49	0.99	0.17	0.84	0.26
1.81	0.25	3.79	0.20	0.93	0.19	0.88	0.47
3.13	0.35	0.81	0.22	0.95	0.31	0.80	0.09
2.61	0.11	1.84	0.14	0.86	0.11	0.78	0.10
2.21	0.64	1.62	0.42	1.03	0.31	0.79	0.10
1.14	0.30	1.44	0.30	0.72	0.08	0.70	0.07
1.11	0.08	1.34	0.38	1.09	0.19	0.74	0.32
1.10	0.38	0.91	0.38	0.95	0.20	0.82	0.47
2.11	0.48	1.68	0.37	0.95	0.31	1.15	0.20
1.20	0.19	1.75	0.26	0.87	0.11	0.81	0.25
1.18	0.20	1.46	0.30	1.03	0.30	0.84	0.45
1.24	0.28	1.29	0.14	0.78	0.24	0.81	0.20
1.32	0.18	1.58	0.38	0.82	0.04	0.84	0.26
1.28	0.44	1.20	0.20	0.84	0.04	0.88	0.47
1.23	0.19	1.43	0.48	0.85	0.08		
1.45	0.30	1.34	0.43	1.09	0.19		
0.94	0.09	1.61	0.49				
		0.82	0.29				
		0.98	0.27				
		1.15	0.18				
		1.33	0.13				
		0.97	0.32				
		1.58	0.20				
		0.81	0.25				
		1.04	0.40				
		1.58	0.34				
		1.36	0.20				
		1.24	0.21				
		1.50	0.48				
		1.03	0.11				
		0.77	0.25				
		1.53	0.20				
		2.50	0.40				
		1.32	0.15				

Table 3

Fig 1a–g. Mortar sample locations and visual appearance



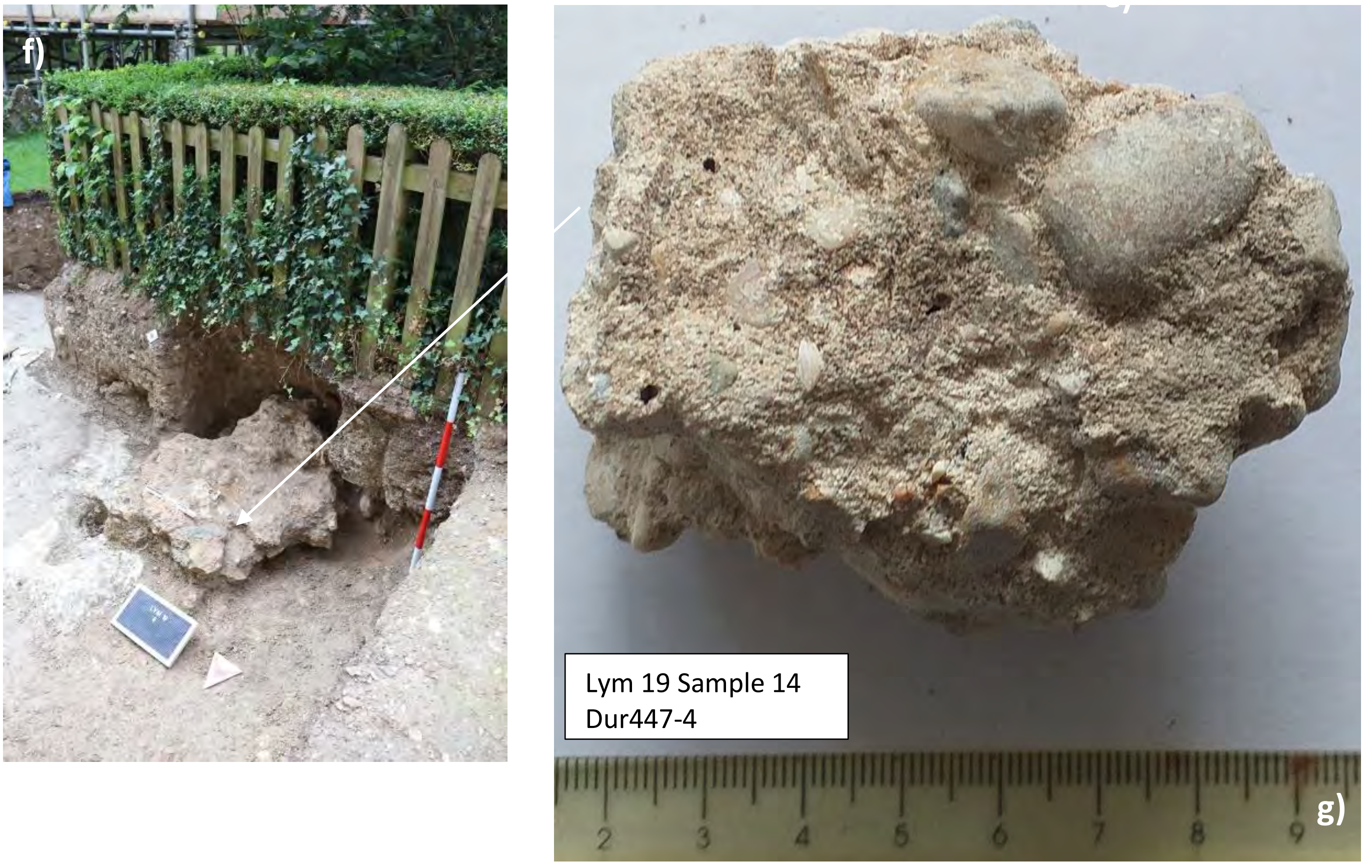
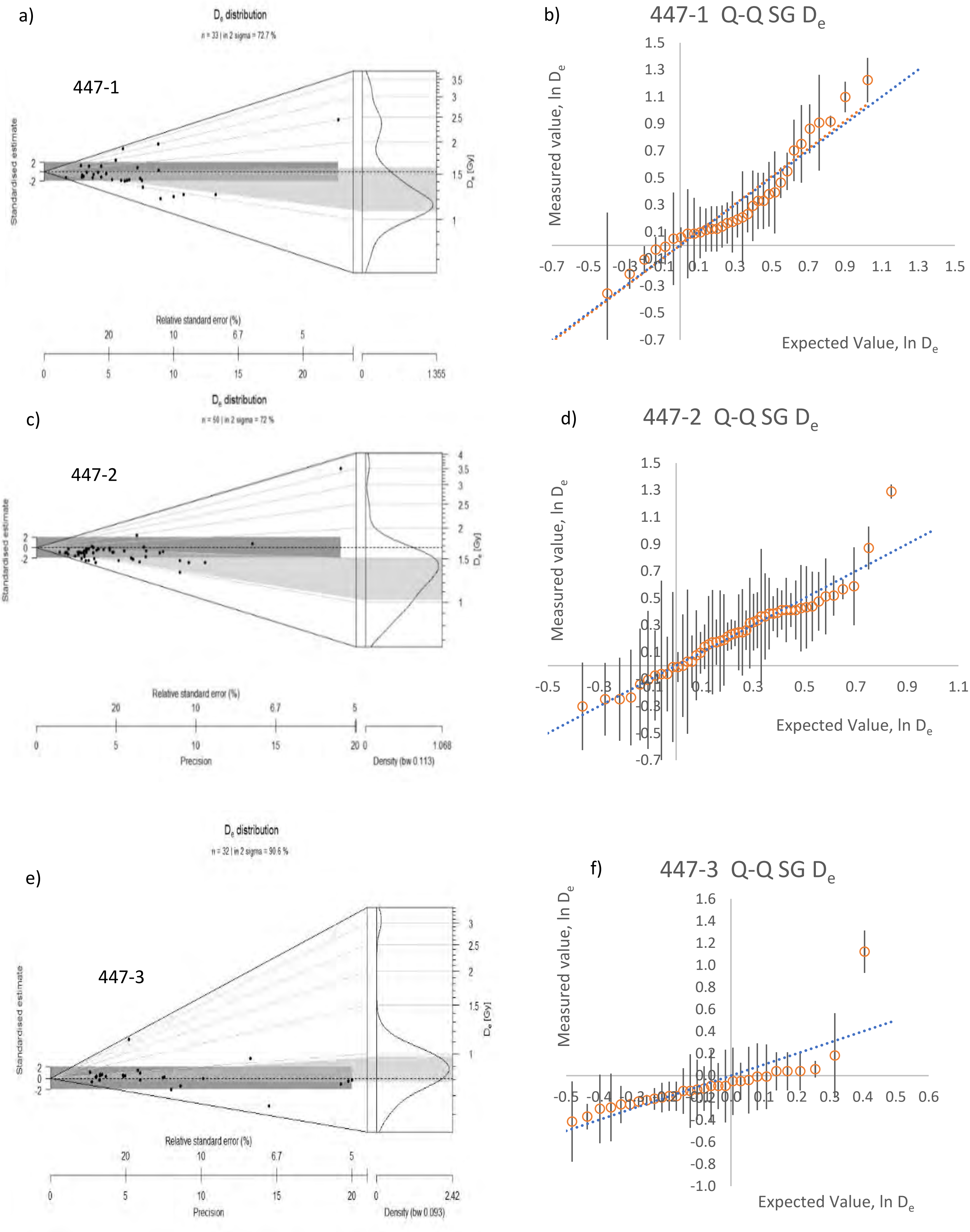
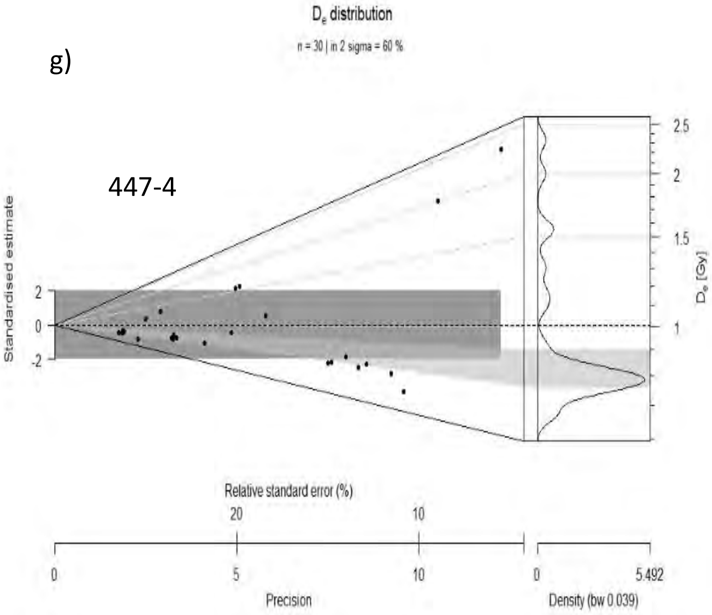

f)
Lym 19 Sample 14
Dur447-4
2 3 4 5 6 7 8 9
g)

Fig 2. Equivalent dose distributions: Abanico and Q-Q plots



g)


De distribution
n = 30 | in 2 sigma = 60 %
447-4
Standardised estimate
Relative standard error (%)
Precision
Density (bw 0.039)
De [Gy]

h)

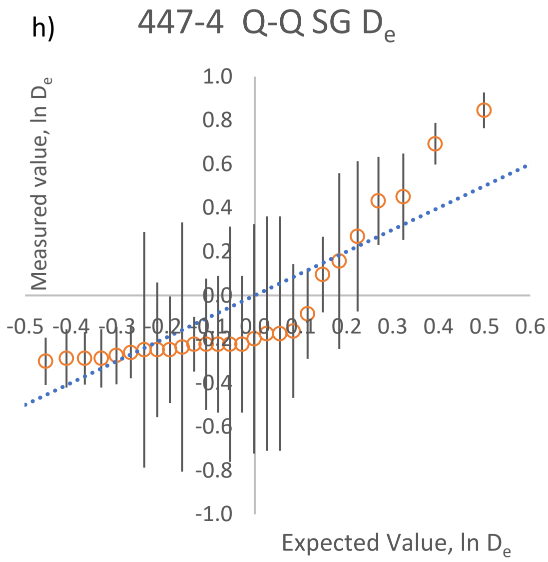
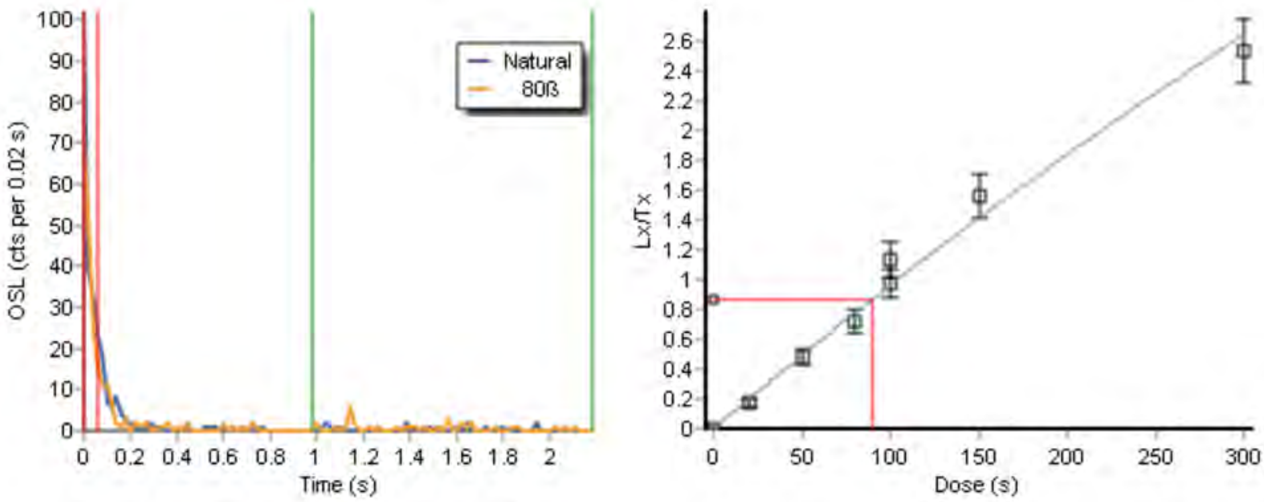
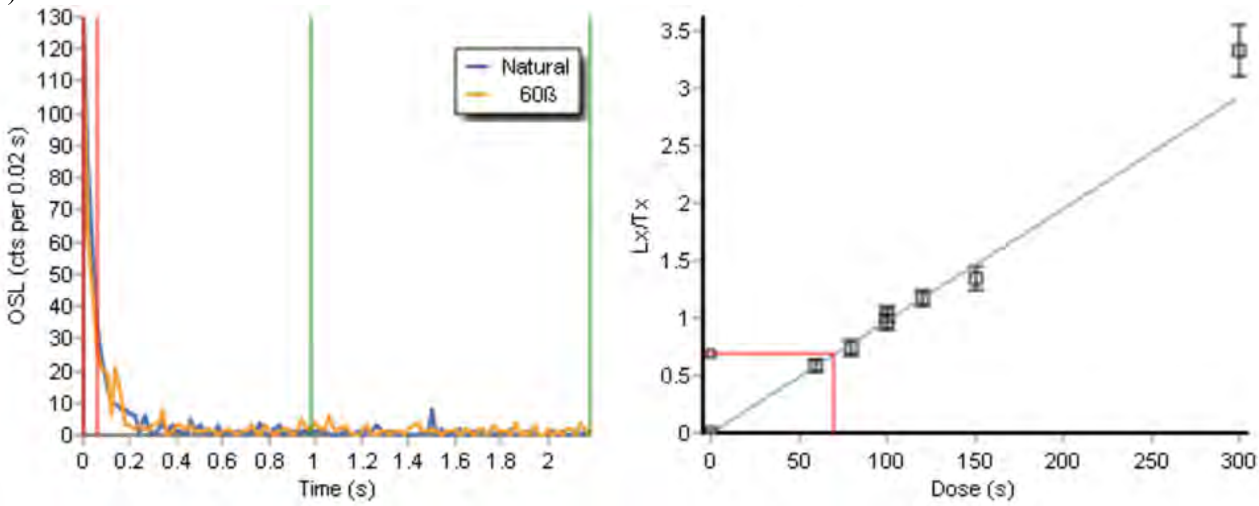

447-4 Q-Q SG De
Measured value, ln De
Expected Value, ln De

Fig 3. Dose response curves

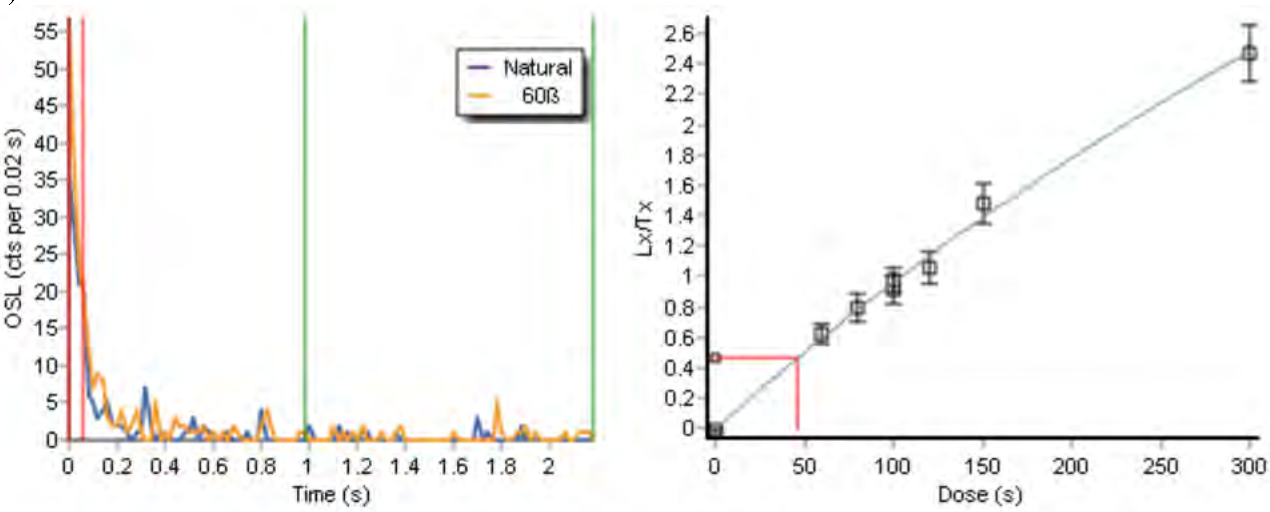
a) 447-1



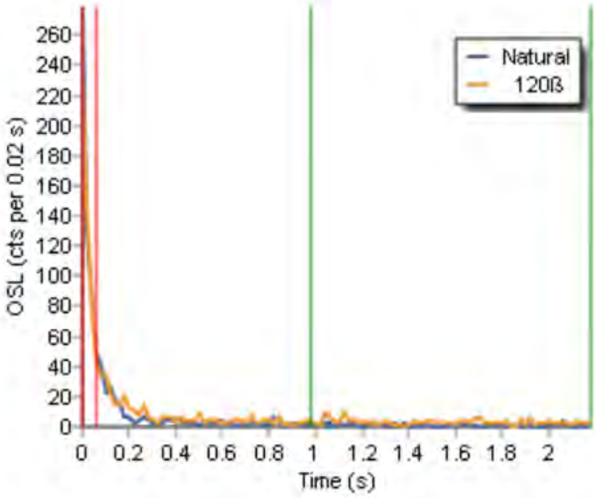
b) 447-2



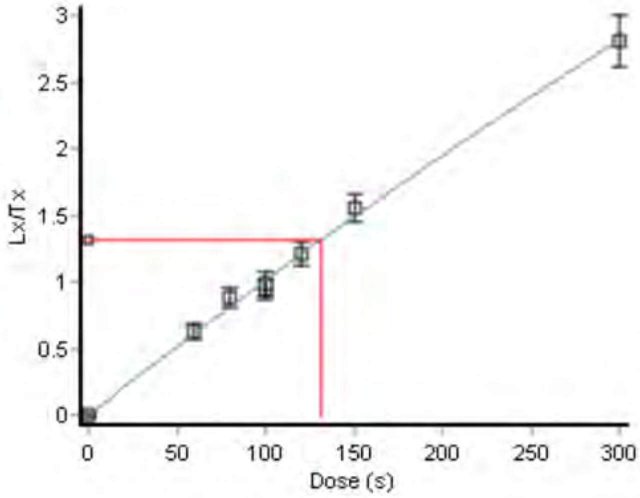
c) 447-3



d) 447-4



OSL (cts per 0.02 s)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
Time (s)
Natural
120ß



Lx/Tx
3
2.5
2
1.5
1
0.5
0
0 50 100 150 200 250 300
Dose (s)

COMPOSITIONAL ANALYSIS OF BUILDING MORTARS FROM LYMINGE

Martin Bell

SUMMARY

The analysis aimed to characterise the mortared foundations of the Anglo-Saxon church and identify any material suitable for dating. Investigation focused on a large block of mortared foundation (Sample 42.1) recovered from the area of the chancel crossing which had become detached from the northern foundation pier (15). Analytical methods included: identification of inclusions on broken surfaces; disaggregation with acid facilitating examination of non-calcareous constituents; physical disaggregation to quantify the proportion of constituents; particle size analysis of the less than 1mm and less than 2mm fractions, using a Malvern Instruments Mastersizer; examination of mortar samples in thin section; and the quantification of elemental composition using portable X-Ray Fluorescence on mortar surfaces and powdered mortar of particle size less than 2mm fractions. Each method provides compositional information on somewhat different spatial scales but together they provide an overall picture of the mortar composition which can be compared to other contexts at Lyminge and elsewhere.

MORTAR THIN SECTIONS

Thin sections were produced using slices of the sample shown in Fig. 1. They were resin impregnated in a vacuum, cut to a slice, re-impregnated in vacuum, cut and ground, mounted on a glass slide, then further ground to the requisite thickness for microscopic examination. The thin sections are shown on Figs. 2–3. Table 1 summarises the constituents of the mortar samples as estimated by eye from the thin sections.

Fig. 1. Hand specimens of mortar Sample 1 (42) prior to sampling for thin section (scale cm).

Sample 42<1> Two thin sections (Figs. 2 and 3) were produced from sample 42<1>. The components are summarised in Table 1. In both, the main course component is rounded to sub-rounded flint gravel (Fig. 6f) which varies between c50% and 30% of the slide. The gravel varies in diameter between 2.5 and 15mm, with a mean of 6–7mm. The gravel pieces have a white surface patination which might derive from their inclusion in highly calcareous mortar. They also have a yellow / brown surface iron staining which is particularly evident in thin sections (Figs. 2–3); this might indicate a Pleistocene gravel source, though it is perhaps more likely to have been acquired *in situ* with patination. pXRF analysis shows iron is abundant. The second most abundant coarse component is red, well-fired clay, crushed brick/ tile which is between 10–20% of the section; this is of variable size, 11mm to 0.5mm. The third most abundant coarse component is broken marine shell which comprises between 5 and 10% of the section, fragments varying in size between 1.7 and 10mm. One or two tiny angular fragments of charcoal, probably from wood, were visible on the section. The presence of a small number of black, probably iron, minerals and green glauconite grains was noted. The remainder of the section comprised quartz sand and calcium carbonate.

	Lyminge Church 2019 sample 42<1> 1/2	Lyminge Church 2019 sample 42<1> 2/2
Rounded flint gravel	50%	30%
Gravel mean size (range)	6.16mm (2.5–15mm)	7.21mm (4–9.5mm)
Fired clay/tile, angular	10%	20%
Marine shell	5%	10%
Chalk	-	-
Sand	present	present
Charcoal	present	?
Other minerals	Glauconite, iron minerals	

Table 1. Components of samples visually estimated from thin sections

Fig. 2. Lyminge Church 2019 Sample 42. 1 of 2

Fig. 3. Lyminge Church, 2019 Sample 4. 2 of 2

PORTABLE X-RAY FLUORESENCE (PXRF) ANALYSIS

This provides elemental analysis of a bulk sample of the mortar in a window of *c* 1cm square. Replicate samples were done of broken mortar surfaces and a powder of the smaller than 2mm fraction. The main elements were calcium (173k ppm) and silicon (154k ppm). The samples were relatively iron (16.8k ppm) and aluminium (14k ppm) rich; the latter is known to improve the hydraulic properties of mortars (Gibbons 1997). The bulk and powder fractions produced similar results.

MICROSCOPE ANALYSIS OF MORTAR COMPONENTS

Analysis of the main mortar block (42<1>) was undertaken to identify charred plant macrofossils for radiocarbon dating. Additionally, it had the objective of characterising the macroscopic components of the mortar. First the natural fracture samples of the mortar were examined for inclusions which were removed for identification. Then the remaining samples were broken up, initially by hand. Remaining lumps were placed in a bag and broken up with a hammer until individual particles were freed. Material retained on a 2mm sieve was subject to identification under a binocular microscope at magnification up to x40. The components identified were:

a) Charcoal There was a small amount of tiny charcoal pieces in the mortar. These fragments are likely to derive from lime burning. Examination by microscope x40 of a 200g sub-sample of Sample 1 produced six fragments, the largest 3 x 1.5 x 1mm (Figs 4 and 8c). It is possible that one or two might be identifiable depending on taxa and features visible. A report on this charcoal has been prepared by Paul Flintoft. Manual disaggregation and examination by eye of a 400g sub-sample failed to identify any larger pieces, suggesting that the charcoal present may be small.

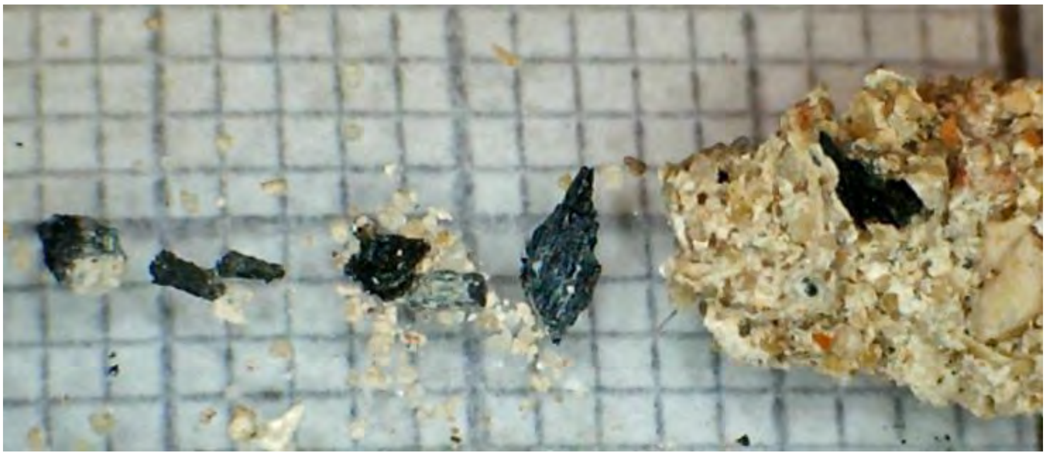


Fig. 4. Lyminge Church mortar Sample 1 (Large block) charcoal (divisions 1mm)

(b) Marine Shell This was an abundant component of the mortar (Figs. 5 and 6d and e). It is mostly of the cockle family with some examples of smaller bivalves, a few gastropod fragments and small fragments of mussel shell. The quantity suggests it is a deliberate component of the mortar. The shells do not show the iron staining evident on the flint gravel which suggests that, if the staining is pre-mortar, the gravel and shells were not derived from the same source. In addition, there is a bag of hand-collected shell fragments from the foundations of the Anglo-Saxon church Sample 12. This contains thirty-two pieces of shell from the cockle family, some of which are immature. There is one complete mature cockle shell and one possible piece of oyster. All the marine molluscs are rounded and eroded, they are unlikely to have come from a midden and are likely to come from a beach.

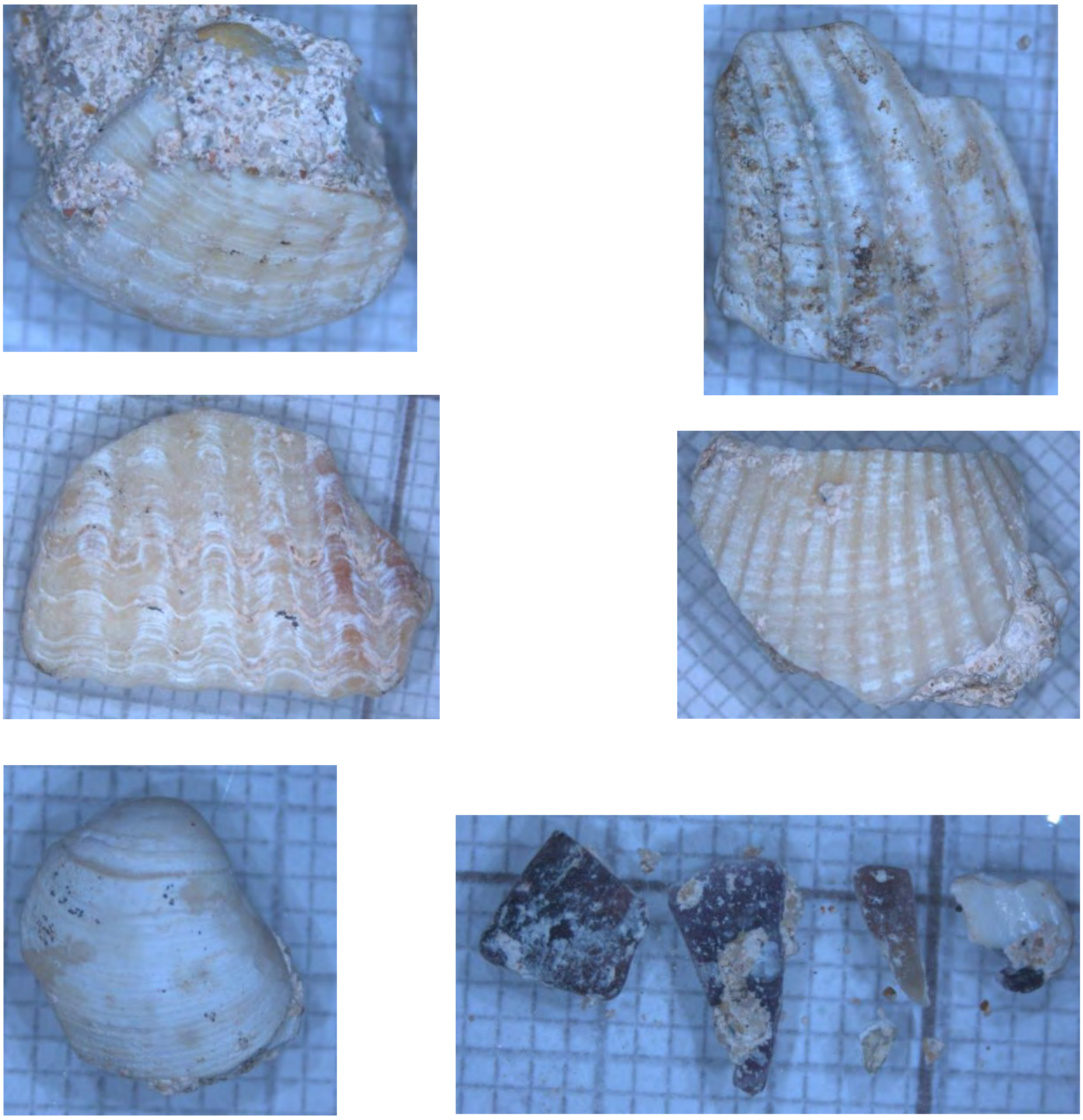


Fig. 5 Shells from Sample 42:1. **Top two rows** cockle family, **third row** (left) small bivalve, **third row (right)** small mussel fragments. Scale mm.

(c) Plant Casts The mortar also included casts of plant material which seems to have been replaced by calcium carbonate (Figs. 6a-c, 7, 8a, b and d). Some of this looks rather like straw or husk fragments that could derive from cereals. There are also some delicately preserved replaced plant structures which look like ferns or moss (Fig. 7). The replaced plants may also include phytolith (silica skeleton) structures. Similar calcified grass is reported from

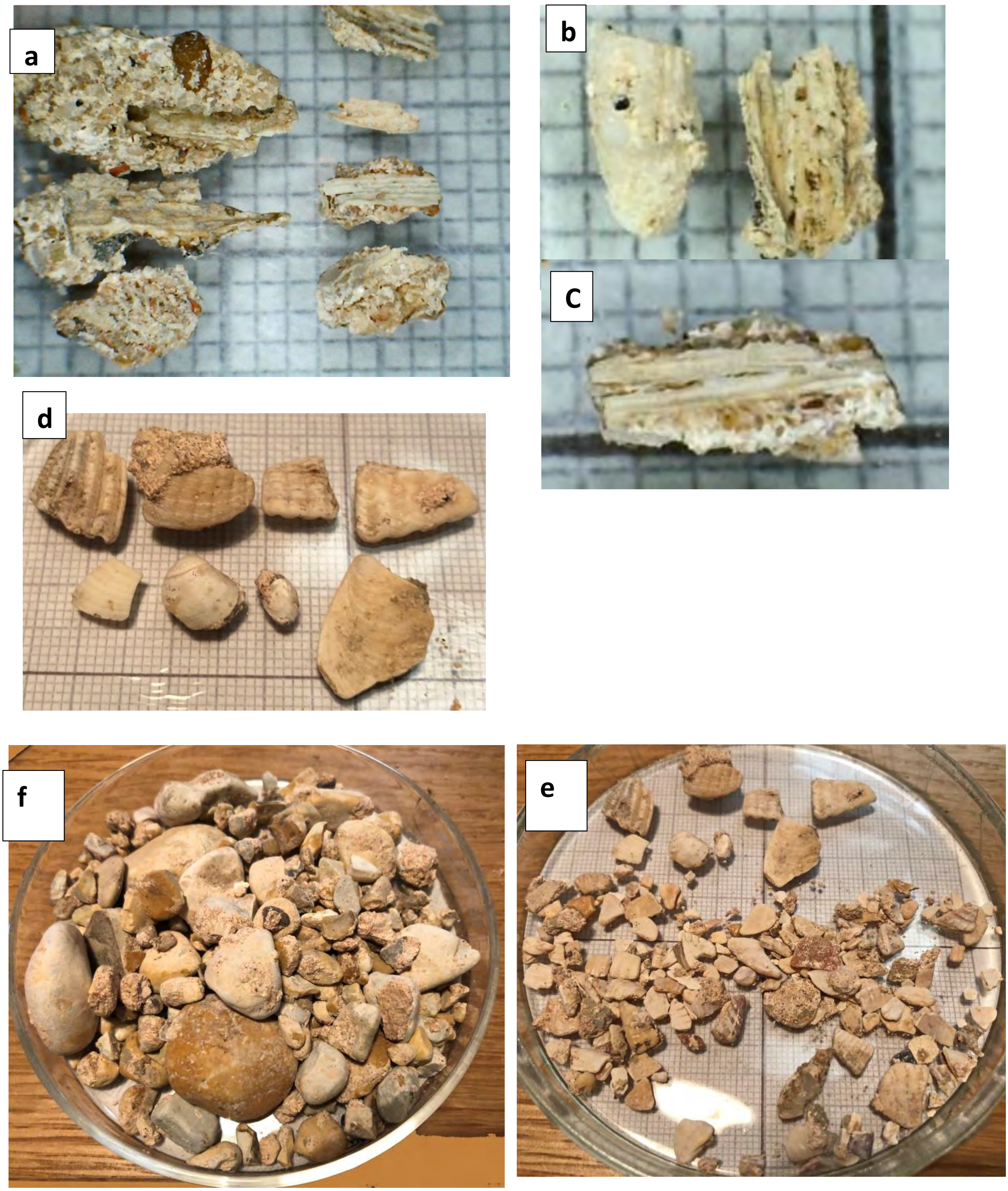


Fig. 6: Lyminge Church mortar Sample 1 (a–c) carbonate replaced plant material; (d–e) marine molluscs; (f) rounded flint beach shingle and gravel. Scales 1mm grid.

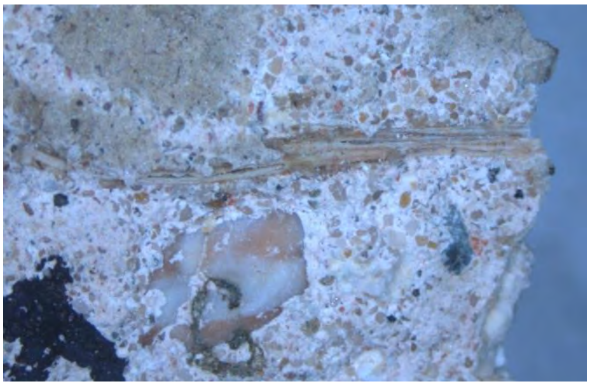


Fig 7. Sample 42: 1 calcium carbonate plant macrofossils.

Top and **bottom** right possible straw/grass

Middle possible fern

Bottom left possible moss

Roman plaster at Lullingstone, Kent (Morgan 1992, fig 6). Of the components, this is the least abundant and the least likely to be a deliberate addition, though it may have been added to increase porosity and help drying. Carbonate replacement is likely to have occurred soon after building for fine detail of the plant fibres to be preserved in the cast.

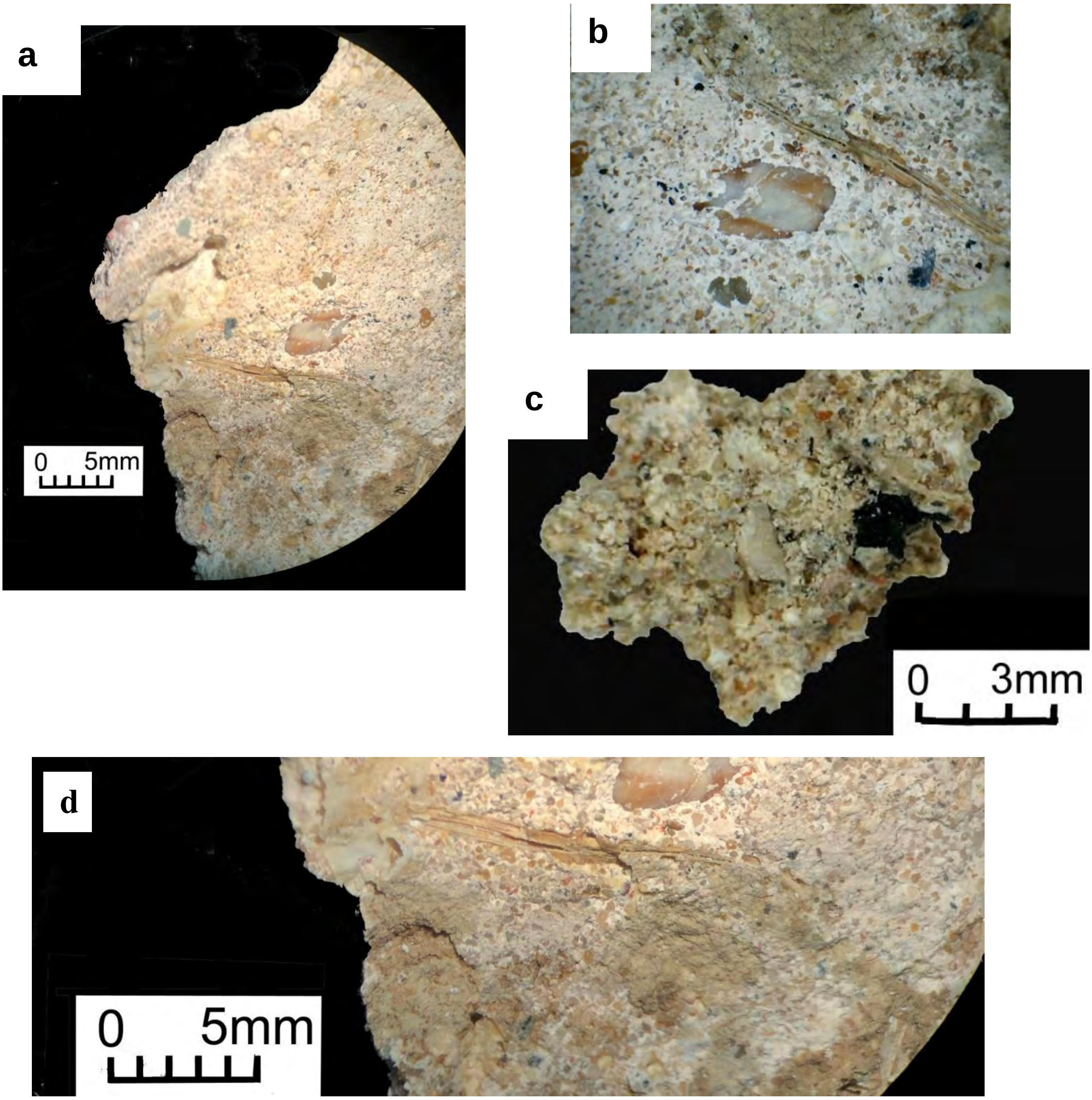


Fig 8. Lyminge mortar sample 42:1: a, b and d replaced vegetation, c charcoal

CONCLUSIONS

The foundation walls of the early church were of mortared flint nodules, probably of field origin. Analysis has shown that the mortar has six components, at least five, perhaps all, of which are thought to represent deliberate additions: (1) Rounded flint gravel of probable beach origin; (2) sand, poorly sorted predominantly coarse to medium; (3) lime; (4) Angular fired clay brick or tile of variable size, gravel to sand grade; (5) Marine shells, mainly cockles, rounded by erosion; (6) Calcified plant material, possibly including straw. The result was a material known as a pozzolon in which materials have been added to lime mortar so that it sets more rapidly and forms a hydraulic mortar, with the added material reacting chemically with calcium hydroxide to form cementitious properties making the mortar harder (Gibbons 1997; Ellis 2002). The characteristic pozzolan component is the crushed brick or tile producing a mortar called *opus signinum,* used particularly in Roman bath houses for its water resisting properties, and more widely in Roman building. This was a frequent component of the 1,289 samples of Roman mortars and plasters from 64 sites analysed by Morgan (1992). His work looked at mortar composition, including gravel, sand and crushed tile, from nearby Roman sites such as Canterbury, Dover, Beauport Park and Lullingstone, with the latter also producing evidence for calcified plant material similar to that at Lyminge. At Lyminge, the pozzolan was of relatively crude composition, given evidence that such a mix is most chemically effective when tile is ground fine (Gibbons 1997); in this case it is of very variable size with some larger pieces (Fig. 3).

Marine shells are not specified as components of the Roman mortar and plaster samples from the 64 sites analysed by Morgan (1992). Shell, and some brick, inclusions are reported in mortars analysed from Brixworth church, Northamptonshire, though their relationship with the Anglo-Saxon phases is unspecified (Sutherland 2013). Organic materials, including vegetable ash, are recorded as pozzolan additives elsewhere (Gibbons 1997; Falkenberg and Mutterlose 2021). As regards sources of mortar components, today's beach at Hythe contains very similar rounded flint gravel with an iron stained and patinated cortex and similar rounded cockle shells (Fig. 9). Beach sampling along the coast between Hythe and Dymchurch shows that the proportion of gravel and rounded cockle decreases west so Hythe is a possible source.

Fig 9 Gravel from modern Hythe beach with rounded flints and cockle fragments. At right fractured gravel shows patinated and iron-stained surfaces

REFERENCES

Ellis, P 2002. 'The Analysis of Mortar', *Hist Churches,* **2002**.

Falkenberg, J and Mutterlose, J 2021. 'Calcareous nannofossils in medieval mortar and mortar based materials: a powerful tool for provenance analysis', *Archaeom,* **63.1**, 19–39.

Gibbons, P 1997. 'Pozzolans for lime mortars. The Conservation and repair of ecclesiastical buildings', in *The Conservation and Repair of Ecclesiastical Buildings*, 4th edn, Cathedral Communications: London.

Morgan, G 1992. 'Romano-British mortars and plasters', unpublished PhD thesis, University of Leicester.

Sutherland, D S 2013. 'Mortars', in D Parsons and D S Sutherland, *The Anglo-Saxon Church of All Saints Brixworth, Northamptonshire. Survey, Excavation and Analysis 1972–2010,* Oxbow, Oxford.

POTTERY FROM EXCAVATIONS AT LYMINGE CHURCHYARD, 2019

Duncan H Brown and Lisa Backhouse

INTRODUCTION

Two trenches, the graveyard and the War Memorial, produced an assemblage of 231 sherds of pottery, with a combined weight of 2,378g, a total rim percent of 201 and a maximum vessel count (where sherds from the same vessel are counted as one) of 222. With an average sherd weight of 10g, the likelihood is that most of this material does not reflect primary deposition and a high degree of residuality is reflected in the occasional presence of prehistoric and Romano-British wares among early, high and later medieval types. The whole assemblage was sorted and recorded by ceramic fabric type, vessel type, sherd type and glaze or decoration and quantified by rim percent, weight in grams, sherd count and maximum vessel count. It was not possible to identify any vessel types to any level of detail and the terms 'jar' and 'jug' were the closest it was possible to get. Recording was undertaken by the authors in February 2020 and data entered into a spreadsheet, which has been submitted for inclusion in the project archive. A fabric type series was created and, where possible, matched with the series developed as part of the Lyminge project. Each fabric has a number and a ware name, or descriptive equivalent. In order to avoid confusion with the established type series, fabric numbering commenced at 600. Only medieval fabrics have been included in the type series. Prehistoric, Romano-British, post-medieval and modern wares were identified but not characterised in detail. After describing the fabric type series, the assemblages from each trench will be considered separately.

WARE TYPES

Twenty-one individual medieval fabrics were identified and can be grouped into early medieval, high medieval and late medieval types. This is not a very well-stratified assemblage and it is therefore difficult to date fabrics precisely but it is worth describing them in some detail because this series supplements the more detailed analysis conducted on the assemblage from the Lyminge project as a whole. With the exception of some matches from the War Memorial trench, the relative lack of types that occur in the material excavated elsewhere in Lyminge suggests that much of this assemblage is later in date. The medieval fabrics have been categorised into three broad period groups; early, high and late medieval. Early medieval includes all pre-Conquest and Saxo-Norman wares, the latter being difficult to separate from their late Saxon counterparts. The high medieval period could be said to commence with the introduction of wheel-thrown wares in the mid-thirteenth century, and represents the flourishing of glazed, highly decorated traditions that decline following the recessions of the mid- to late fourteenth century. From the late fourteenth century, late medieval wares were introduced, lasting until the appearance of post-medieval types in the mid-sixteenth century. Table 1 shows the quantities present for each ware type, which are described below.

Early medieval wares

RP 35 Weight 397g Sherd count 41 MVC 40

Early medieval wares at Lyminge have been studied in detail elsewhere and a variety of types and groups have been formulated based mainly on the range of inclusions. The types present here are similarly characterised by their principal constituents rather than association with any known production sites. Several ware types/groups within this assemblage can be broadly matched with the Lyminge type series, particularly the most dominant types derived from the later seventh- to ninth-century settlement sampled nearby. However, several new types are also represented, which suggests that they post-date those assemblages and are likely therefore to date to the tenth, eleventh or twelfth centuries. They are all hand-built and probably fired in clamp-type kilns, which also indicates an early medieval date. There are few sherds diagnostic of form but apart from a bowl rim, the prevalent vessel type is the round-shouldered jar/cooking pot, with an everted rim, that typifies early medieval assemblages in southern England.

Shell-tempered pottery is the most common early medieval coarseware type, accounting for 128g and represented by two fabrics: 605 and 614. Fabric 605 is comparable to 198 in the Lyminge type series. In that larger assemblage, shell-tempered wares, including Fabric 198, are dated to the later seventh to ninth centuries. Fabric 614 is fired much harder and a later tenth- or eleventh-century date is suggested.

Ill-sorted sandy coarseware is a dominant presence in the mid-Saxon assemblage from Lyminge. Fabric 616 has been matched with Fabric 102 in the Lyminge type series, one of the most common ill-sorted sandy coarsewares and dated to the fifth to seventh centuries.

There are three flint-tempered coarseware fabrics, two of which have been matched with the Lyminge type series: 609 with 228; 620 with 252. A seventh- to eighth-century date is suggested for fabrics 609/228 and 620/252. Fabric 617 is hard-fired, with abundant white flint and a tenth or eleventh century date is possible.

Chalk-tempered coarseware, Fabric 606 is a hand-built coarseware with abundant ill-sorted quartz sand and moderate chalk inclusions. It has not been matched elsewhere in the Lyminge type series and a late Saxon or Saxo-Norman date is likely.

Flint and chalk-tempered coarseware, Fabric 618, has moderate to abundant ill-sorted white flint, with sparse medium chalk and moderate, fine, rounded quartz and it cannot be matched elsewhere in the Lyminge type series. A small, simple upright rim sherd may have come from a bowl.

Fabric 613 is equivalent to 211 in the Lyminge type series. This is a North French greyware, fired grey throughout and with well-sorted fine quartz, and has an eighth- to ninth-century attribution. There are three small sherds, all with a diamond-roulette decoration.

High medieval wares
RP 142   Weight 1,682g   Sherd count 154   MVC 150

Table 1 shows that the assemblage is dominated by high medieval wares, mainly in the form of Canterbury-type ware, Fabric 600. This is a hard-fired, sandy wheel-thrown coarseware, usually dark grey in colour, with well-sorted, medium quartz inclusions. The earliest, late tenth-century, manifestation of this product is frequently knife-trimmed (McPherson-Grant 1995; Cotter 2015) but there is little evidence of that here and an eleventh- to early thirteenth-century date range is most likely. The only diagnostic sherds are everted rims from jar/cooking pots. A few base sherds are likely to be from similar vessels.

There are three additional medieval coarseware fabrics, 603, 608 and 612. Fabric 603 has moderate to abundant quartz with sparse chalk inclusions. Fabric 608 is hard-fired with abundant ill-sorted quartz and sparse red iron, flint and chalk. Both of those are represented by single sherds. Fabric 612 has moderate to abundant, ill-sorted quartz with moderate coarse and medium shell inclusions. There are five sherds of this fabric, including a rim with external thickening and an internal incised wavy line.

High medieval glazed sandy ware occurs in four fabrics, 601, 602, 604 and 621, all of which are local products. Fabric 601 is a sandy redware with a dark-green glaze over a white slip; 602 is pink-grey in colour with sparse flint and chalk among ill-sorted quartz inclusions, decorated with a vertical thumbed applied strip under a slightly reduced green glaze; 604 has pink-red surface colour and is comprised of a fine sandy clay with larger white clay pellets and occurs as a fragment of a narrow strap handle; 621 is a redware with medium to fine quartz and sparse red iron and greenish-clear glaze. All of these sherds are most probably from jugs and are likely to date from the mid-thirteenth to mid-fourteenth century.

Late medieval wares
RP 14   Weight 96g   Sherd count 8   MVC 8

Fabrics 607, 610 and 622 are locally produced, highly fired late medieval sandy wares. Fabric 607 (three sherds) has dark-grey brown surfaces and a clay matrix of moderate, medium-fine quartz sand with inclusions of medium and coarse red iron clay pellets. There are four sherds of Fabric 610, which is dark grey-brown in colour and has abundant, rounded, medium quartz with sparse fine red iron. One sherd is a fragment of a jug rim, with an external reduced green glaze and a rilled neck. Fabric 622 is pink-grey in colour, with moderate fine quartz, sparse red iron clay pellets and very sparse fine and medium chalk inclusions; the single sherd present here is decorated with applied vertical strips and has splashes of greenish-clear lead glaze. These wares fit into the late medieval tradition of well-fired sandy wares of more utilitarian character than the richly glazed and highly decorated types of the high medieval period.

Post-medieval wares
RP 0   Weight 6g   Sherd count 2   MVC 2

Two post-medieval wares are represented by tiny body sherds. These are: post-medieval redware, which represents a long-standing tradition of richly glazed red sandy earthenware that persisted all over the south of England from the mid-sixteenth to early eighteenth centuries; Frechen-type stoneware, with the characteristic 'orange-peel' pimpled salt glaze. This has a similar date-range from around 1550 to 1700.

Modern wares
RP 0   Weight 40g   Sherd count 2   MVC 2

One fragment of flower pot and another from a stoneware drainage pipe are also present.

ARCHAEOLOGICAL CONTEXTS

The Graveyard Trench

Thirteen contexts produced an assemblage of fifty-nine sherds, weighing 926g, with a total rim percent of seventy-five and a maximum vessel count of 5fifty-six. Thirteen sherds (281g; RP 3; MVC 12) came from three unstratified contexts, derived from machining and hand-cleaning (contexts 5, 10 and 66) and described as redeposited graveyard material that included large quantities of disarticulated human bone. The remaining stratified assemblage is shown in Table 2, in which ware types are quantified by weight and sherd count for each context. No contexts produced exclusively early medieval pottery, and high or late medieval wares are present throughout. All the pottery is badly fragmented and, in many cases, abraded, which indicates that it is all redeposited and no context can be securely dated beyond the provision of a broad *terminus post quem*.

The War Memorial Trench

Seventeen contexts produced an assemblage of 172 sherds and 1,452g, with a total rim percent of 126 and a maximum vessel count of 166. Four contexts were unstratified (808, 809, 825, 883) but they account for 122 sherds and 1,066g with a rim percent of ninety-four and a maximum vessel count of 121. The remaining fifty sherds are shown in Table 3, quantified by weight and sherd count according to context. There is no pottery later than Canterbury-type sandy coarseware and two features, pit 822 and posthole 853 contained exclusively early medieval material, albeit in very small quantities. The presence of prehistoric pottery in pit 822 suggests that all the pottery is residual. As with the graveyard trench, no secure dating can be offered beyond a *terminus post quem.*

This is a small assemblage, much of it unstratified and all of it probably redeposited. The principal interest is in the range of fabrics, which extend the Lyminge type series into the Saxo-Norman and high medieval periods. The sherd size is universally small and very little of this material can be related to specific activities around the church, although most of it is contemporary with the active use of that building in the medieval period.

REFERENCES

Cotter, J 2015. 'Post-Roman Pottery', in P Andrews *et al* (eds) *Digging at the Gateway Archaeological Landscapes of South Thanet, The Archaeology of East Kent Access (Phase II) Volume 2: The Finds, Environmental and Dating Reports*. Oxford and Sailsbury: Oxford Wessex Archaeology, 247–78

Macpherson-Grant, N 1995. 'Post-Roman', in *Canterbury: Marlowe Car Park and Surrounding Areas, Part II: The Finds*. Canterbury: Canterbury Archaeological Trust, 815–96

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Ware types	Rim %	Weight (g)	Sherd count	MVC
Prehistoric	5	25	12	8
Romano-British wares	5	132	12	12
Chalk-tempered coarseware		26	3	3
Flint-tempered coarseware	4	93	7	7
Flint and chalk tempered coarseware	11	35	2	2
Shell-tempered coarseware	11	128	14	14
Early medieval sandy coarseware	4	56	7	7
Early medieval imported greyware		20	3	2
Canterbury-type sandy coarseware	139	1487	146	143
High medieval coarseware	8	79	7	7
High medieval sandy ware		155	6	5
Late medieval high-fired sandy ware	14	96	8	8
Post-medieval redware		4	1	1
Frechen Stoneware		2	1	1
Modern drain pipe		13	1	1
Modern flower pot		27	1	1
Totals	**201**	**2,378**	**231**	**222**

Table 1. Quantities of each ware type in chronological order of period group

Context Number	Context type	Shell-tempered coarseware	Flint-tempered coarseware	Canterbury-type sandy coarseware	High medieval coarseware	Glazed red sandy ware	Late medieval sandy	Post-medieval redware	Modern drainage pipe	Total weight / Sherd count
28	Layer						10 / 1			10 / 1
44	Graveyard backfill	10 / 1	16 / 1	378 / 22	25 / 1				13 / 1	442 / 26
47	Graveyard backfill						28 / 1			28 / 1
49	Graveyard backfill	5 / 1		25 / 3						30 / 4
50	Graveyard backfill			25 / 2						25 / 2
52	Path surface						6 / 1	4 / 1		10 / 2
67	Grave backfill	15 / 2		6 / 2						21 / 4
74	Grave fill					3 / 1				3 /1
75	Layer			52 / 3						52 / 3
82	Grave fill	19 / 1					5 / 1			24 / 2
Total weight / Sherd count		**49 / 5**	**16 / 1**	**486 / 30**	**25 / 1**	**3 / 1**	**49 / 4**	**4 / 1**	**13 / 1**	**645 / 46**

Table 2. Graveyard trench: quantities of different ware types in each stratified context

Context number	Context type	Prehistoric	Romano-British	Shell-tempered coarseware	Flint-tempered coarseware	Flint- and chalk-tempered coarseware	Sandy coarseware	Early medieval imported greyware	Canterbury-type sandy coarseware	Total weight / Sherd count
806	Pit 807			4 / 1					32 / 2	36 / 3
821	Pit 822	12 / 7			71 / 5	28 / 1				111 / 13
827	Gully 826		4 / 1						9 / 1	13 / 2
833	Pit 832					7 / 1		9 / 1	16 / 2	32 / 4
845	Pit 844	2 / 3							9 / 1	11 / 4
846	Wall foundation								12 / 2	12 /2
847	Cut 846								8 / 1	8 / 1
848	Layer	6 / 1	8 / 2		14 / 3		8 / 1		55 / 5	91 / 12
850	Posthole 849						15 / 1		28 / 1	43 / 2
854	Posthole 853			5 / 1						5 / 1
882	Timber slot 881		1 / 1				10 / 1		3 / 1	14 / 3
887	Feature 886								3 / 1	3 / 1
891	Posthole 890								7/ 2	7 / 2
Total weight / Sherd count		**20 / 11**	**13 / 4**	**9 / 2**	**85 / 8**	**35 / 2**	**33 / 3**	**9 / 1**	**182 / 19**	**386 / 50**

Table 3. War Memorial trench: quantities of different ware types in each stratified context

Photographed sherds
LYM 19 Context 821, Fabric 618m, early medieval bowl
LYM 19 Context 808, Fabric 613, imported greyware with stamped rouletted decoration

BUILDING MATERIAL FROM LYMINGE CHURCHYARD EXCAVATIONS, 2019

Cynthia Poole

INTRODUCTION AND METHODOLOGY

A small quantity of building material was submitted for analysis from trenches excavated in 2019, relating to the Saxon and later medieval church. The assemblage comprised mortar and wall plaster amounting to seventeen fragments (839g) and ceramic building material comprising nine fragments (609g). The assemblage has been fully recorded in accordance with guidelines set out by the Archaeological Ceramic Building Materials Group (ACBMG 2007) and is summarised in Table 1. Fabrics were characterised on the basis of macroscopic features supplemented by the use of x20 hand lens and no scientific analysis has been carried out to identify the mineral components of either the paint or mortar.

WALL PLASTER AND MORTAR

The wall plaster and mortar were recovered from four contexts. The earliest datable context was the foundation pier of the nave crossing of the Anglo-Saxon church (15) from which a single sample was taken. This consisted of a broken fragment of Roman brick, 37mm thick, made in a hard, fine red clay fabric. It was encased in remnants of a light brown lime mortar mixed with a high density of medium sand, mostly translucent or amber quartz, together with a lower density of dark, green-black grains of glauconite, with a scatter of coarser grits of tile, quartzite and flint up to 8mm.

All the remaining pieces of mortar and wall plaster were found residually, the majority in the graveyard soil encompassing the apse of the Saxon church (44, 66), or in association with the medieval wall foundation (847) from the War Memorial trench.

Fabrics

Four mortar fabrics (M1–M4) were identified:

- M1: Light grey — pale-brown, lime mortar containing a high density of opaque white medium coarse quartz sand, and a scatter white lime balls/chalk <5mm.
- M2: White-cream or pale-brown lime mortar mixed with a high density of opaque and translucent white and amber, medium, rounded-subrounded quartz sand, a low density of green-black glauconite sand up to 2mm and a low-moderate density of coarser aggregate comprising small quartz or quartzite pebbles, flint/chert gravel and pebbles up to 15mm and more rarely rounded chalk up to 7mm and shell fragments.
- M3: Light grey-pale brown, lime mortar containing a high density of opaque white and amber medium coarse quartz sand, moderate scatter of black iron pyrites sand and frequent coarse inclusions up to 14mm of flint pebbles and gravel, shell, and tile grit.
- M4: Pale creamy brown lime mortar mixed with moderate density fine-medium quartz sand and coarse inclusions of chalk <10mm and small black inclusions that appear to include charcoal and possibly other burnt organic remains <2mm.

Fabric M2 was the most common, used also for the foundation pier of the Anglo-Saxon church, whilst the other fabrics were found in only one or two examples. The glauconite present in type M2 indicates the sand aggregate originated from Greensand deposits which outcrop 3km to the south and south-west of Lyminge (BGS 2020). The lime itself could be produced from the local chalk deposits.

Description

Apart from one fragment from context 44 that formed a broken amorphous piece containing coarse flint gravel aggregate, which probably derived from a concrete foundation for wall or floor, the remaining pieces consisted of wall render or plaster. These pieces formed thin flat slabs usually of a single layer of mortar ranging in thickness from 8–15mm or 20–26mm. The back bonding face was present on several pieces and presented a flat or slightly undulating rough surface sometimes with coarser grits protruding, indicating the plaster had been laid over a primary rough finished render surface. Rarely, impressions of coarser stones from the underlying wall structure were present.

The outer visible wall surface of the plaster was generally smooth and finished to varying degrees. This ranged from a very smooth flat polished surface through a fairly standard flat smooth surface to examples with a slightly uneven surface or with small blemishes. Most of the fragments from context 44 had a plain unpainted cream surface to the mortar plaster, or in a small number of examples remnants of a white lime wash. The piece from context 66 had been uniformly painted with a plain matt maroon-plum red paint. No edges to the paint were present and it is not known whether this colour covered extensive areas or narrower bands of colour. No narrow stripes were represented.

The fragment discovered in association with the medieval wall foundation (847) was painted matt maroon-plum red of a similar colouration and hue to the piece from context 66.

Discussion of the wall plaster

The plaster assemblage is small, and inevitably the evidence is limited for the internal finish of the Anglo-Saxon church. It may be concluded that the plaster was predominantly white, with some areas painted red. What form the red areas took it is not possible to say on the available evidence. Wall plaster excavated from contemporary structures is rare. Mortar recovered from excavation of the Saxon church of St Mary's, Deerhurst, produced very little evidence of painted surfaces and what little survived was white or cream suggesting a fairly austere interior (Rhatz 1976, 33–4). At Wearmouth and Jarrow, the plaster from the monastic buildings included white and red painted plaster, occasionally combined with black. At Wearmouth, narrow red bands or stripes, mostly straight, though including a few curved, may have formed panels set within the wall (Cramp and Cronyn 2006, 7). At Jarrow, the plaster was decorated with geometric designs based on stripes and circles painted in red on a cream ground (Cramp and Mac Mahon, 2005, 10) as well as plain matt red plaster. The complex geometric designs were laid out with scored lines that guided the painting. No evidence for decorative designs is present in the paintwork of the Lyminge plaster, nor were any scored lines encountered to suggest its presence or anything as complex as the Jarrow plaster. If anything, the Lyminge plaster is closest in character to the 'matt red' plaster that was most likely to be associated with the Saxon church at Jarrow (Cramp 2006, 15), whereas the more decorative plaster was associated with other monastic buildings.

Later post-Conquest excavated assemblages from medieval religious houses have produced limited evidence of a greater range in colour and design. At Glastonbury Abbey, the large assemblage was confined mainly to red line decoration on a white ground, with occasional blue-black lines and areas of ochre yellow. The extensive use of this limited range of decoration possibly representing foliage, scroll work or drapery, is more typical of basic schemes of a quality similar to parish churches (Caple 2015). Similar red and black lines painted on a white ground probably of mid-thirteenth century date was found at Selborne Priory, where it was interpreted as representing mock ashlar, though other simple designs represented by curving lines and areas of ochre wash are also present (Baker 2014).

In conclusion, the wall plaster from Lyminge is closest in character to that associated with the church at Jarrow, probably representing a simple bichrome decorative design lacking the more complex geometric patterns found in the associated monastic buildings of Jarrow and Wearmouth or in later monastic foundations and churches.

CERAMIC BUILDING MATERIAL

The roof tile comprising eight fragments (510g) was all recovered from test pit 1 from demolition material of medieval date from the building represented by the wall foundation 847, and one brick fragment (99g) came from the vicinity of test pit 4 (noted as path reduction east of War Memorial trench).

Brick

The corner fragment of brick measures 43mm (1¾ins) thick and has a smooth upper surface with indented borders 10mm wide along both edges, rough base and stretcher surface and a more even header with rounded arrises and corner. The outer surfaces are covered in pale blue-green vitreous vitrified veneer, which could have been caused by overfiring during the primary firing process, or as a result of use in a kiln such as a glass furnace. It was made in a yellowish-brown fabric containing a high density of fine sand, a scatter of diffuse rounded mudstone up to 14mm and occasional shell grit up to 8mm. This bears some similarity to the Type 3 brick fabric at Battle Abbey, where it is suggested to be a Flemish import from the Low Countries of fourteenth–sixteenth century date (Streeten 1985, 101).

The brick thickness is typical of medieval bricks and accords best with medieval ‘Great Bricks’ of mid-twelfth to mid-thirteenth century date, which were 1½–2ins thick, though the standard bricks, which occur from the mid-thirteenth century are only a little thicker, averaging 2ins (Brunskill 2009, 37). It is not uncommon for early handmade bricks to vary to some considerable extent across the entire brick, often thinning to the corners, so it is possible the complete brick would have had an overall thickness closer to the 2ins of standard bricks. Bricks of similar thickness (Type 4i) found at Battle Abbey amongst Dissolution debris are assigned a fifteenth–early sixteenth-century date. Indented borders or sunken margins are most commonly observed on Tudor and Stuart bricks of late-fifteenth to mid-seventeenth-century date such as those found at Hampton Court but are also a consistent feature of Dutch ‘clinker’ bricks. The general characteristics, size, colour, fabric and firing have most in common with Dutch ‘clinker’ bricks (Smith 2001), which are of *c* fifteenth–seventeenth-century date, rather than any locally made product.

Where brick was used in medieval churches, it was on a limited scale, usually in quoins, window dressing and arches (Brunskill ibid, 115–16). However, if this brick has been accurately identified as a Dutch ‘clinker’ brick, these were generally used in floor, path or yard surfaces and it may have been used in a post-medieval path through the church yard, rather than as part of the medieval church structure.

Roof tile

The roof tile all came from flat rectangular tiles, of which half could be positively identified as peg tiles from the presence of peg holes. Most were made in a hard orange/red fabric, often with a thin grey core containing low-moderate density of medium quartz sand. One group of three fragments was made in a very fine sandy fabric and a single example was made in a light pinkish brown fine silty smooth clay, containing no inclusions, but some scattered voids may indicate organic temper had been added.

The tiles generally had a fairly rough crude finish with striated upper surfaces from wiping and sometimes lumpy upper surfaces (probably from clay pellets within the fabric), rough sanded bases and edges, which sometimes have slight lips along the upper arrises. They ranged in thickness from 11 to 14mm, but no other dimensions survived complete. The best preserved was a fragment measuring more than 85mm long and more than 115mm wide, estimated to be *c* 125mm wide if the peg holes had been placed symmetrically, though this would be unusually small compared to the more standard 150–60mm. This piece has two oval peg holes measuring 19 by 15mm tapering to 10 by 8mm set 20mm apart and centred 22–5mm from the top edge and 40mm from the side edge. This piece is also distinguished by a dog paw print 45mm wide comprising the four toe pads and two claw marks.

The other peg tile fragments all had circular peg holes measuring 11 and 15mm in diameter centred 17–25mm from the top and 36–60mm from the adjacent side edges. On one tile, the peg holes were encircled by halos of thickened clay *c* 23–5mm diameter on the underside of the tile.

The roof tile cannot be closely dated: rectangular peg tiles become established in the mid-thirteenth century and have continued in use to the present day. Until the introduction of mechanisation there is little difference in character apart from changes in size relating to various statutes and a general progression from a crude to a neater finish. The general character is consistent with a medieval date and the very close spacing of the pair of peg holes also suggests this: at Battle Abbey the thirteenth–fourteenth-century peg tiles had more closely spaced peg holes than those from later phases (Streeten 1985, 97). No glaze was observed, but this is not always present on medieval tiles and when present was only applied to the lower halves of peg tiles.

Table 1: Summary of the building material assemblage

Context	SF	Nos	Wt g	Material/ fabric	Form	Phase	Context description
15	<11>	1	76	Tile in mortar M2	Roman brick fragment	7th century	Foundation pier of nave crossing of Anglo-Saxon church
44	72 a	1	81	Mortar M1	Wall plaster with plain cream surface of plaster or occasionally with evidence of whitewash		General graveyard soil encompassing the footprint of the Anglo-Saxon church and immediately adjacent areas. Generated as a result of centuries of medieval and post-medieval grave digging, but incorporates residual material directly derived from the fabric of the Anglo-Saxon church, portions of which were truncated by post-Saxon graves.
44	72 b	1	52	Mortar M2			
44	72 c	1	18	Mortar M3			
44	73	4	173	Mortar M3			
44	-	1	104	Mortar M2			
44	-	1	75	Mortar M2	Concrete foundation		
66	70 A	1	23	Mortar M4	Wall plaster		
66	70 A	1	29	Mortar M2	Wall plaster with red painted surface		
847	-	5	208	Mortar M2	Wall plaster with red painted surface	Medieval	Mortared wall foundation
Mortar	*Total*	*17*	*839*				
				Ceramic building material			
U/S	-	1	99	Fine sandy, clay pellets and shell	Glazed brick ?Dutch 'clinker'	15th-17thC	Discovered in vicinity of TP4
TP1	-	1	178	Sandy	Roof: peg tile with paw print	Medieval	Demolition material associated with building denoted by foundation 847
TP1	-	3	90	Sandy	Roof: peg tile		
TP1	-	3	209	Fine sandy	Roof: peg tile		
TP1	-	1	33	Silty	Roof tile		
CBM	*Total*	*9*	*609*				

REFERENCES

ACBMG 2007. *Ceramic Building Material, Minimum Standards for Recovery, Curation, Analysis and Publication.* Archaeological Ceramic Building Materials Group

Baker, E 2014. 'Wall plaster', in D Baker, *Selborne Priory Excavations 1953–1971*, Hampshire Field Club Archaeol Soc Monogr 12, 130-2, Hampshire Field Club and Archaeological Society

BGS 2020. British Geological Survey, Geology of Britain Viewer: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Brunskill, R W 2009. *Brick and Clay Building in Britain* (Vernacular Buildings), Yale University Press, New Haven

Cramp, R 2006. *Wearmouth and Jarrow Monastic Sites Volume 2*, English Heritage, Swindon

Cramp, R and Mac Mahon, A 2006. 'The decoration of the polychrome plasters', in Cramp 2006, 8-15.

Cramp, R and Cronyn, J 2006. 'Polychrome plasters', in Cramp 2006, 6-8.

Caple, C 2015. '*Ex-situ* painted wall plaster', in R Gilchrist and C Green, *Glastonbury Abbey Archaeological Investigations 1904-79*, Soc of Antiquaries, London, 337–40

Rhatz, P 1976. *Excavations at St Mary's Church Deerhurst 1971-3*, Council Brit Arch Res Rep 15, London.

Smith, T P 2001.' On 'small yellow bricks … from Holland'', *Construction Hist,* **17**, 31–43

Streeten, A D F 1985. 'Ceramic building materials', in J N Hare, *Battle Abbey The Eastern Range and the Excavations of 1978–80*, 77–10

COINS FROM THE 2019 EXCAVATIONS IN LYMINGE CHURCHYARD

David Holman

The 2019 excavations produced a total of fourteen coins of considerable heterogeneity ranging over some 2,000 years and with only one find of numismatic significance (see Table 1). All of the coins were from topsoil, or layers that had been previously disturbed and none were in a primary context. The use of a metal detector increased the total significantly from what it would otherwise have been.

The earliest coin found was an Iron-Age potin coin of the Kentish Primary series, dated to the mid-second century BC and likely to be the earliest coin type produced in Britain. These are not uncommon finds across much of east Kent and one of the four currently known hoards of these coins was found within Lyminge parish.

There were two Roman coins, one of which, from a much later context within the early Anglo-Saxon chancel, is pierced. This coin is too worn to be identified other than to say that it is of first or second century date. The piercing could have occurred at any time after this but it may be significant that numerous other pierced Roman coins were found during previous excavations at Lyminge, which in some cases certainly came from Anglo-Saxon contexts. Taken in conjunction with the lack of evidence for Roman period occupation in Lyminge, it can be inferred that the 2019 pierced coin was most likely adapted in the post-Roman period, perhaps for use as a pendant. The other Roman coin found in 2019 is a small late third-century radiate copy which shows no sign of adaptation and, like the potin coin, is perhaps a casual contemporary loss rather than an object curated during the Anglo-Saxon period.

The highlight among the 2019 coins was undoubtedly a penny of Ceolnoth, Archbishop of Canterbury (833–870). This was a spoilheap find in soil derived from adjacent to the war memorial. It is of the Floriated Cross type, a design also used by Aethelberht of Wessex (858–865/6) in the latter years of his reign, and Ceolnoth's issue is thus thought to be around the same date (*c* 862–866). This is probably the last of the 'facing bust' issues, which had been in vogue for the ecclesiastical series since the archbishopric of Wulfred (805–832). It is only the third recorded specimen and the second complete coin at the time of writing.[1] It is from the same reverse die in the name of the moneyer, Biarnred (Beornraed), as both the other coins, but from a different obverse die, which is the first indication that the issue was probably larger than the tiny surviving corpus would suggest. However, the fact that the Floriated Cross type has yet to be found in a hoard, unlike earlier types of Ceolnoth, suggests that it may have been a smaller issue than those earlier types.

The coin is in unworn condition, although with small patches of cuprous corrosion suggesting some debasement of the silver. Attempting to assess the date of deposition of a single effectively unstratified coin is problematic. Earlier types of Ceolnoth — and other issuers from, sometimes, decades earlier — are known from several hoards, including Dorking (dep. *c* 865/6), Beeston Tor (dep early 870s), Trewhiddle (dep early 870s) and Cuerdale (dep *c* 905), showing that they could have remained in circulation for some years after minting.[2] On balance, however, the condition of this coin, together with an obverse design which would have marked it out as unusual just a few years later, perhaps suggests a date of deposition not too long after the date of issue, probably no later than *c* 875.

[1] The others are an unprovenanced fragmentary coin in the British Museum (accession no. 1947.14.4.6), and a complete specimen from Driffield, Yorkshire, possibly from a small hoard; see Naismith 2011, type C.218.
[2] Thompson 1956.

None of the Anglo-Saxon coins found during previous excavations at Lyminge are of this date, a period when the documentary sources are silent, but this coin indicates a continuing presence on the site of the monastery well into the third quarter of the ninth century.

There were four medieval coins, split between the excavation adjacent to the church and the separate area leading to the war memorial. The earliest of these can be dated to *c* 1170 and was found alongside the medieval building found under the path leading to the war memorial. The same area also produced a cut farthing of the mid-thirteenth century. These coins may hint at the date when the building was in use, but equally may be casual losses not directly related to the structure. From a chalk path crossing the chancel of the early Anglo-Saxon church came a penny of Edward I (1299–1301), but other finds from this layer indicate a much later, post-medieval date and it thus appears that this coin inadvertently found its way into the path during construction. The latest medieval coin, dated to the early 1480s, came from heavily disturbed later grave fill in the area of the destroyed south-western corner of the Anglo-Saxon church. None of these coins is in fresh condition and all were probably lost several years after their production date. In summary, these medieval coins represent a typical selection for the period, but in the absence of any from primary contexts, little else can be deduced from such a wide-ranging sample.

Lastly, a typical selection of post-medieval coins from the seventeenth to the twentieth centuries was recovered. These included a Victorian halfpenny dated 1862 found underneath the porch, tying in neatly with the excavation undertaken shortly beforehand by Canon Jenkins. As with the medieval coins, it is likely that all these arrived as the result of casual losses.

Table 1: a list of coins from the excavation

Period	Issuer	Description	Mint	Moneyer	Den	Date	Reference	Cond.	Weight (g)
Iron Age	Cantiaci	Kentish Primary Series (chipped)	*	*	Potin	c.175-125 BC	As Van Arsdell 1402	Corr	2.23
Roman	Uncertain	Fig. stg. l.? (pierced)	*	*	As	C1-C2	*	EW	8.82
Roman	'Tetricus I'	Rev. illegible apart from V (offcentre)	*	*	Radiate copy	c.274-286	*	UW	1.36
Anglo-Saxon	Abp. Ceolnoth	Group III, Floriated Cross, CEOLNOÐ ARCHIEP' / BIARNRED MONETA	Canterbury	Beornraed	Penny	c.862-866	North 247; Naismith C.218	UW	1.09
Medieval	Henry II	Cross & crosslets, Class C-E […]EF[…]	London?	Geffrei?	Penny	c.1163-1174	As North 956	SW	1.32
Medieval	Henry III	VLC Cl.3c or 4 [………ON]CAN	Canterbury	N/K	(Cut) farthing	1248-1251	As North 988	W	0.27
Medieval	Edward I	Class 9b (clipped)	London	*	Penny	1299-1301	Spink 1408	W	1.09
Medieval	Edward IV	mm. long cross fitchee (clipped)	Canterbury	*	Halfpenny	1480-1483	Spink 2141	W	0.33
Post-medieval	Charles I	Maltravers class 2 (mm bell both sides)	*	*	Farthing	1634-1636	Spink 3198	SW	0.44
Post-medieval	Charles II	*	London	*	Farthing	1672-1675	Spink 3394	SW	
Post-medieval	William III	*	*	*	Halfpenny	1695-1701	As Spink 3554	EW	7.94
Post-medieval	Victoria	*	*	*	Halfpenny	1862	Spink 3956	Enc.	5.47
Post-medieval	George V	*	*	*	Halfpenny	1913	Spink 4056	W	5.35
Post-medieval	George V	*	*	*	Halfpenny	1923	Spink 4056	SW	

REFERENCES

Naismith, R 2011. *The Coinage of Southern England 796–865, Vol I,* London

North, J J 1994. *English Hammered Coinage, Vol I, Early Anglo-Saxon to Henry III c 600–1272*, London

Spink and Son Ltd, *Standard Catalogue of British Coins: Coins of England and the United Kingdom, Part 1*, 50th edition (2015), London

Thompson, J D A 1956. *Inventory of British Coin Hoards A.D. 600–1500*, Royal Numismatic Soc Special Publ No 1, Oxford

Van Arsdell, R D 1989. *Celtic Coinage of Britain*, London

NOTES ON THE FABRIC AND GEOLOGICAL CONSTITUENTS OF SS MARY AND ETHELBURGA, LYMINGE (EXCLUDING THE TOWER)

Christopher Green

METHODOLOGY AND GENERAL OBSERVATIONS

The study of the fabric was constrained. Ideally, recording should extend to all the clasts and the mortars they are set in; in practice two alternatives apply: Over the north wall of the chancel, and north and north east walls of the nave, a white coating of ?whitewash, carbonates, probably silicates, and white crustose lichens has obscured the stonework over the course of centuries, and identification beneath this layer would necessarily be intrusive. Growths of moss have compounded all this near ground level. Where the white layer has been removed, the contemporary solution was to repoint in a Portland Cement mortar, shown yellow ochre in the drawings (Figs 1–3). Where an individual stone has been invisible beneath its white patina, its form may help identification. Two principal stones used in the early years of the church were ferruginous sandstone from the Lenham Beds, and a form of Oligocene limestone thought to be the Binstead Limestone from the Isle of Wight. Though they may be of similar hue, the Lenham Beds stone is emphatically not a freestone, and was usually employed with little or no cutting (where blocks are flattened it has been by pecking); Binstead Stone is however a freestone, often seen in the form of squared blocks, even bearing ?saw marks (evidently it was a relatively soft stone when freshly quarried), and could be shaped to form the closely fitting voussoirs of windows.

Sharp junctions between Lenham and Binstead stones are visible in parts of the nave wall (south) and the chancel wall (north and south) (Figs 1–3) and it appears that these may have formed successive supplies to the builders in the eleventh century.

Several interventions may be associated with the church's chief restorer, Canon Jenkins. Canon Jenkins's restoration was presumably responsible for the movement of the Caen Stone string course from the chancel parapet to the plinth of the north and north-east sides of the nave where it is today. Jenkins presumably had the chancel parapet removed, although its ceiling was also raised, as is evident on the north side.

The round-headed Romanesque windows are said by Tatton-Brown (1991) to have been re-opened by Canon Jenkins but are also often observed to have been shortened (Newman 1983; Berg and Jones 2009, 172) (ie stone mortared into their sills), but this may have been done to accommodate the fifteenth-century windows (Fig 1). The fabric survey showed evidence of a number of squared Binstead Limestone blocks alongside the fifteenth-century window to the east of the porch, and it may be that a round-headed Romanesque window was removed and replaced at this point (if so, we may suspect that there was another where the window on the south side is now). Canon Jenkins certainly carried out works in this area, as Lenham sandstone masonry has been cut away and the whole repointed with Portland Cement to the east of the Porch.

There is an unexplained scar on the north-east end of the nave, abutting the chancel, which may denote the removal of a buttress there. A buttress in an apparently anachronistic material — Ragstone — strengthens the centre of the nave on the north side, and this may have been the only source of large stones available to Jenkins at that time.

As discussed in the main text, it may be that Jenkins created or augmented the 'niche' (through which it was claimed pilgrims could see the remains of St Ethelburga), using many small pieces of Roman ceramic building material to form a low arch (Fig 2). The more telling feature, geologically, is the slab forming the floor of the niche at ground level. Though it is hard to determine the specific stone in its current position, it should be noted that it is longer than any other piece of stone used in the fabric, and it may even be a sawn Ragstone headstone taken from the adjoining graveyard. Irrespective of the precise identity of this stone, Jenkins is the most likely candidate for the arched niche in its present form, an identification supported by the fact that the wall above the niche has been repointed in Portland cement of some age. Jenkins is also thought to be responsible for the preservation of the plinth on which the church is built and which almost supports the niche, building it up with small pieces of Lenham ironstone or (chancel north side) with modern bricks topped by Lenham Stone.

Fig 1. South elevation of church (eastern section) showing geological identifications (scale approx 1:100). Drawing by author based on results of laser scanning survey and select photogrammetry

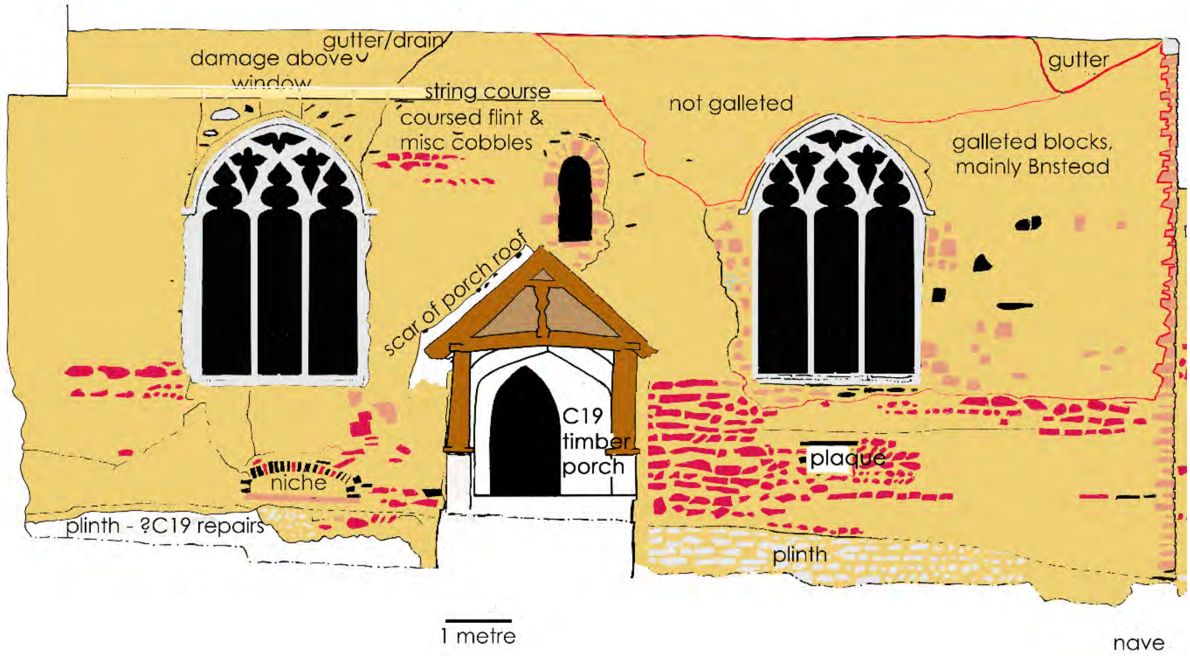


Fig 2. South elevation of church (western section) showing geological identifications (scale approx 1:100). Drawing by author based on results of laser scanning survey and select photogrammetry

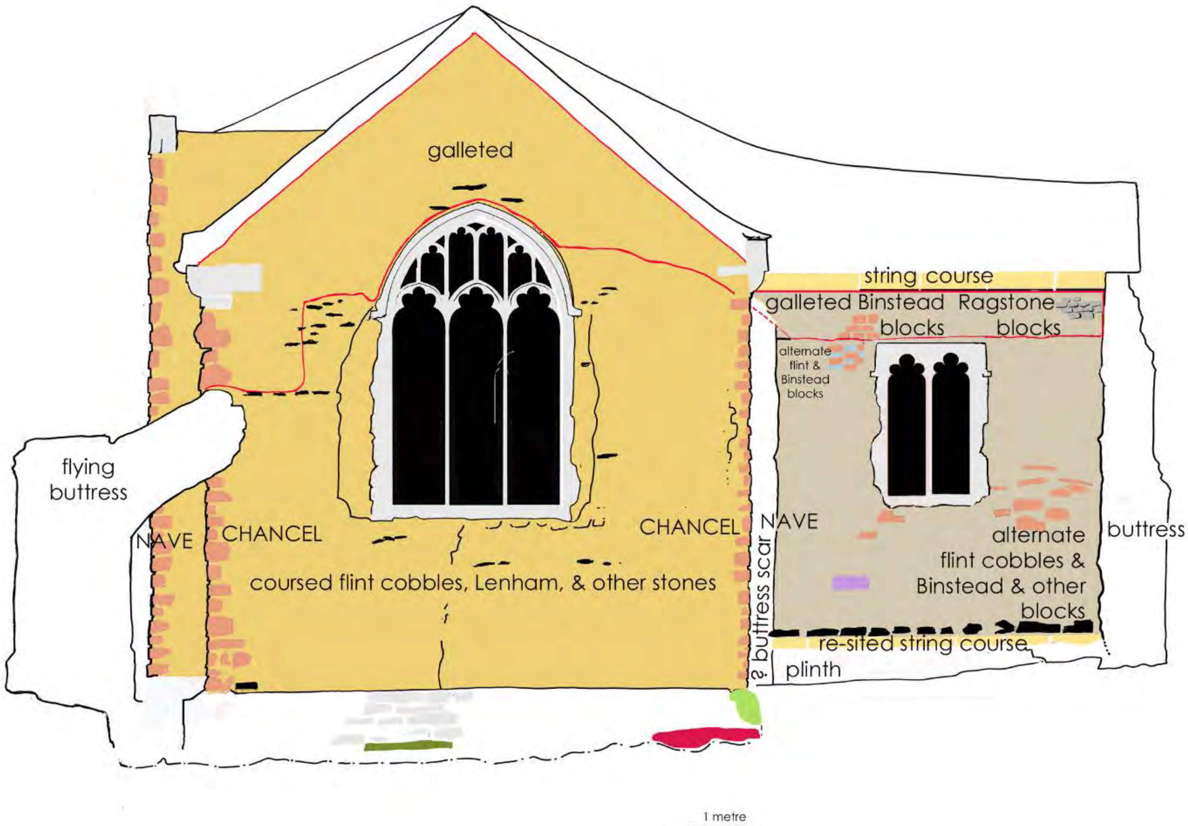
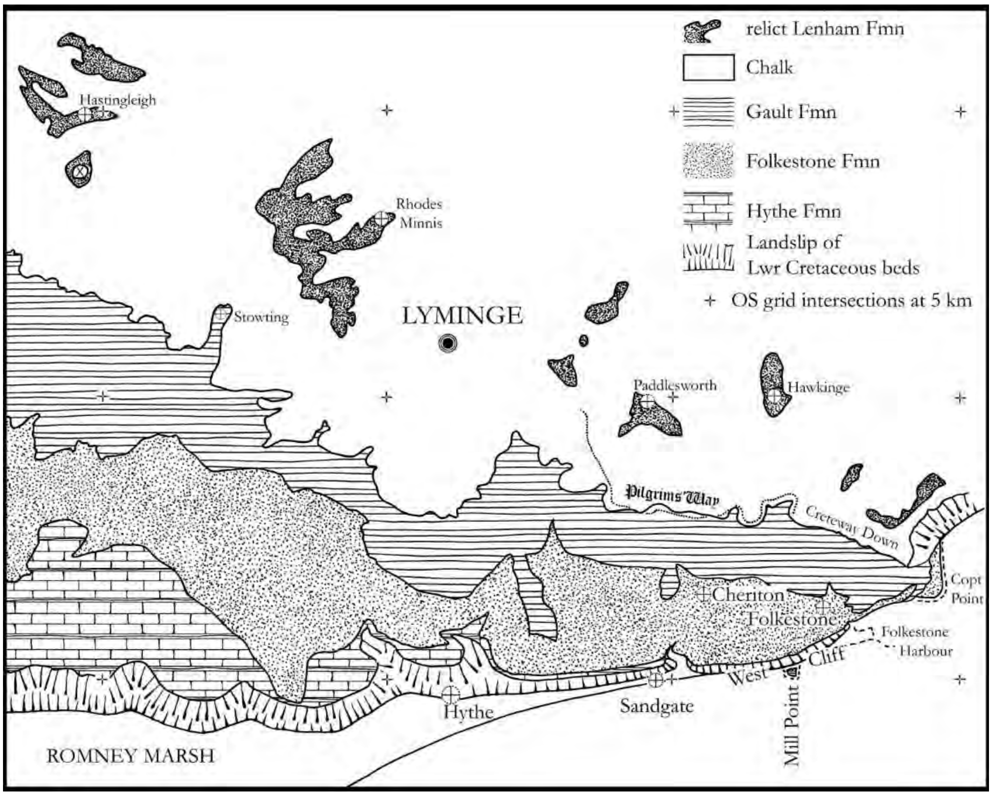


Fig 3. Eastern elevation showing geological identifications (scale approx 1:100). Drawing by author based on results of laser scanning survey and select photogrammetry

GEOLOGICAL IDENTIFICATIONS

The following geological formations provided stone for the fabric of the standing church, the occurrence of which is shown on the map below.



Sketch map of the solid geology of the Lyminge District: data from British Geological Survey. The area lies on the south edge of the North Downs

Caen Stone
A Jurassic limestone from coastal northern France west of Rouen, may have formed the string course seen *in situ* on the south side of the nave, but was apparently partially removed from that face, the chancel, and the north side of the nave, and placed near ground level on top of the plinth on the north side of the church. Caen Stone is cream coloured and without distinguishing features to the naked eye. This string course has not yet been studied closely but the identification is likely in that much Caen Stone was imported to England after the Norman Conquest, and because it would have been available in the large sizes preferred for such work (see Hayward 2009, 87). No other possible examples were identified, though Tatton-Brown (1991) says that it was used.

Purbeck Marble
A familiar shelly limestone from the uppermost Jurassic of east Dorset; bluish grey and packed with gastropods. A single block was found in the north wall of the nave.

Ragstone from the Hythe Formation
It is a Lower Cretaceous (Aptian) hard bluish grey limestone with fine to medium quartz sand, and often calcite fossils and microfossils. It occurs as beds interspersed with 'hassock', a softer deposit (Worssam 1963). It will be seen from Figure 1 that this area marks the eastern limit of the Hythe Formation and throughout the extent of the map from Romney Marsh to Hythe it forms a solid scarp above an extensive landslip of earlier clays. It has been extracted for building stone in late Roman times along the scarp above Stutfall Castle (Hutchinson *et al* 1985), and from perhaps the eighteenth

century above the town of Hythe itself; exposures of unknown age are still open between the two. However there was no source certainly open in Saxon times, and suspicion falls on the West cliff at Folkestone, where the Hythe Formation (dipping gently to the north and east) has passed below sea level, but was raised to low water mark on the 'toe' of the rotational landslips which were so much a feature of this coast before the construction of Folkestone Harbour (1800 onwards, blocking long-shore drift, stabilising the West Cliff, but accelerating marine erosion beyond; Smart *et al* 1966, 291 ff; Hutchinson *et al* 1980). Mill Point, a reef of Ragstone with a strong northward dip, is the present day example (with the embayment of its landslip to the north), and is thought to have provided stone for Sandgate Castle in Tudor Times (Worsaam and Tatton-Brown 1993); no doubt the Saxon/Norman source has long since eroded away. In Victorian times, the largest supplies of Ragstone were quarried to the north and west, especially in the Medway valley, and sources in east Kent were ignored (Worssam 1963). At Lyminge, Ragstone was largely used for the tower, and where large blocks of stone were needed for nineteenth-century repairs, for instance to form a buttress on the north nave wall.

'Folkestone Rock': Calcareous Sandstones from the Folkestone Formation

Discontinuous calcareous layers occur within the slightly consolidated sands of the Folkestone Formation (Lower Cretaceous, Albian), largely within the urban area of Folkestone and its suburb, Cheriton. A very tough mid- to dark-grey rock results, though it weathers to a yellow or greenish yellow, coloured by glauconite. The clasts, of well-rounded quartz and glauconite, may be 2mm or more in diameter so the stone is quite distinctive. It reacts strongly to acid tests, and burial in acid soil may remove surface detail and leave clasts standing on the surface. The Folkestone Formation crops out on the coast along the East and West Cliffs at Folkestone, and over 10 lenses may be seen in the whole sequence. The slabs of rock, which may be 5m in length, wash out of the cliff very easily, and are now best seen at Copt Point to the East of Folkestone Harbour (NGR: TR 2436), where they stretch some 300m out to sea at low tide; this however is simply the remains of Copt Head, the Gault Clay cliff washed away in mid-Victorian times when the construction of Folkestone Harbour had cut off its protective shingle bank. Before 1800, the West Cliff, scene of many landslips, was a much better place to collect slabs of Folkestone rock (NGR: TR 1934-2235; Hutchinson 1969 and Hutchinson *et al* 1980). Even before the construction of the harbour, Folkestone provided much of the largest coastal supply of hard building stone between North Yorkshire and the Purbeck in Dorset.

Other Glauconitic Sandstones

Unfamiliar medium to fine sandstones were found supporting the NE corner of the Chancel, and surrounding the chancel door. English Heritage guidance suggests that they may be referable to the Palaeocene Thanet Sands of the coast around Reculver, but comparison by the author doesnot support this view, and these rocks must be suspected to be unusual and unidentified lithifications utilised by masons who would build with anything reasonably hard.

Chalk and Flint

The solid geology beneath Lyminge is the lower members of the Upper Cretaceous Chalk Formation, but most of the surroundings are free of super incumbent 'drift' deposits. Blocks are only seen under the eaves on the north side of the chancel, added when the nave ceiling was raised by Canon Jenkins.

Flint cobbles are common throughout the higher formations of the Chalk, but not in Lyminge's geology; they will have had to be collected from fields probably to the north, or from beaches at, perhaps Sandgate or Folkestone, where flint was winnowed from chalk by the continuous action of the waves. They were extensively used in Lyminge church, but often alternate with Lenham, Binstead or other clasts, especially when laid as 'rubble' in plentiful mortar: an indication that there was too little solid stone. Very little flint is seen inside the church where its plaster has been stripped. Lenham Stone then takes its place, and it has been concluded that flint cobbles were used largely as a conveniently cheap and readily obtainable material for the repair of a stone building, though whether the stonework repairs the cobbles laid in mortar or vice versa can only be told by further observations during building works, or during a radical campaign of repointing.

Binstead Limestone and 'Quarr Stone'

The church fabric makes substantial use of Oligocene limestones from the St Helens Member of the Solent Formation in the north of the Isle of Wight. The stone at Lyminge has been referred to 'Quarr Stone', raising awareness of the use of Isle of Wight stones in Kent and London (Tatton-Brown 1980), but introducing a source of chronological confusion. Quarr Stone *sensu stricto*, also known as 'featherbed', was of very restricted distribution and was worked out within one or two centuries of the Norman Conquest.

It is a pale-yellow facies of Binstead Limestone, light in weight as it is packed with the empty casts of broken fossil gastropod shells; and never pinkish as it is at Lyminge (pers comm A Gale 2021); at Lyminge, the stone also contains only a few patches of (smaller) gastropod fossils. It is referred instead to the more widespread Binstead Limestone following Clifton Taylor (1987, 60–1), who says, 'unlike Quarr Stone it embodies a considerable quantity of iron, which on exposure sometimes changes its naturally creamy colour to a rich dark russet.' Aldsworth noted that two distinct types of the stone, from separate sources, had been used at Bosham (Aldsworth 1990). Binstead Limestone was most used in Hampshire and West Sussex but was worked out in medieval times (ibid). Nonetheless its much longer date range should prevent the attribution of much of the Lyminge fabric to the late eleventh or tweflth centuries on the basis of its stonework, as Tatton-Brown (1991)and Berg and Jones do (2009, 172).

The stone was evidently soft when extracted, and cut into rectilinear blocks with a chisel or even a saw, leaving diagonal marks. It was used for the round-headed windows, whose voussoirs required careful cutting, the surviving quoins of the nave and chancel, and at higher levels in the fabric of the walls, alternating with flint cobble on the NW wall of the chancel. At three or four places it was seen close to, and always above, Lenham Stone, encouraging the view that Lenham Stone was the original choice, and that Binstead Limestone was used when the larger blocks of Lenham had run out.

Lenham Formation Ironstone

This varies from a deep purplish red to the colour of rust, usually with lighter-colour surfaces. Many of the larger fragments had formed as a layer no more than 100mm in thickness, and whose presumed upper surface was channelled or 'plicate'. (The development of hard deposits like these sandstones, and their sculptured surfaces, presumably results from the percolation of water over geological time, and is analogous to iron pans formed in other circumstances.) The iron content is great enough to make this rock substantially denser than others recovered from the site, though it is unclear whether it was usable for iron smelting. It is clear from the local geology that it is preferable to the Lenham Beds, an early Pleistocene, Pliocene, or (it has been argued) even a Miocene, marine deposit confined to the North Downs in England, and named from a village some 24km WNW, near which fossiliferous deposits have been found. Pending further work it is probably best thought of as Plio-Pleistocene, contemporary with the East Anglian Red Crag. The outcrop is now very sporadic, but has been traced from the North Downs of Surrey to Belgium (Gossling and Woolridge 1926; Balson 1999), and is clearly evidence of a greatly raised sea level in south-eastern England during later Neogene times (see Jones 1999, 15–20). Deposits on the North Downs are now seen collapsed into solution pipes in the chalk, and are treated by the Geological Survey as being immediately older, in the local geology, than the periglacial Clay-with-Flints. The Lenham Beds are therefore a near-surface deposit, and are reduced by weathering and by human activities, particularly quarrying and farming. The areas shown in Figure 1 (from Geological Survey data) are shrinking and more or less interspersed with blocks of sandstone from former deposits. It was obviously present in some abundance in Saxon times. It will be seen from Figure 1 that the easternmost occurrence of the deposits is at Creteway Down and there farming operations continually bring to the surface material identical to the rock under discussion. Secker noted the Lenham sandstone (as a 'purple-brown' form of Folkestone Sandstone) on the surface between Lyminge and Paddlesworth, 3km ESE, and also as a minor building material at Aldington Church 13km SW (Secker nd). At Lyminge, it is seen to the east of the Porch (ibid), and throughout the lower parts of the chancel, and to a lesser extent the nave.

CERAMIC BUILDING MATERIAL (CBM)

CBM was found fairly sparsely, and in small pieces, throughout the church fabric, and much of it appears to be Roman. Such a small amount provides, if anything, negative evidence for the pre-existence of a Roman building on or near the site.

POINTING, MORTAR, AND GALLETING

Most of the mortar so abundant in the church uses Portland Cement, a relatively quick-drying sinter of clay and chalk (see Clifton-Taylor 1987, 51–2), and distinct in every way from the previously used lime mortar. Generally, this has been applied a little thicker than the previous lime mortars, with a markedly reduced area of stone clast to inspect. Portland cements were introduced approximately from the 1840s and so Canon Jenkin's builders might have been able to use them, but much of the surfaces seen today is suspected to be later, of the twentieth century, and is marked by the use of a yellow-orange sand. Areas of the upper walls have been galleted, ie flakes of (preferably)flint have been pressed into the mortar to accentuate and strengthen its pointing. Galleting belongs to the Portland cement era, post 1840, and is a Kent speciality (ibid, 53); it is difficult to repoint around it, so it is assumed to be *in situ*, and again is probably associated with Canon Jenkins' works.

TRANSPORT

In identifying West Cliff, Folkestone, as the source of most of the stone used at Lyminge, the problem of transport is naturally raised, as the stone was obtained at sea level, while Lyminge stands at just over 100m above OD and about 15km inland. There is no certainty, but an obvious route would be to tackle the climb immediately, passing through what is now modern Cheriton and the Channel Tunnel terminal to join the Pilgrim's Way, the historic route passing E–W along the chalk scarp of the North Downs, until it was convenient to turn inland (NW) for Lyminge (Fig 1). Richardson and Parfitt provide an alternative, and not very distant way to a 'ridgeway' route (2021, 74–5). The route for any Lenham Formation ironstone may well have also been along the Pilgrim's Way, especially if it had been obtained at Creteway Down above Folkestone, a not unlikely source.

REFERENCES

Aldsworth, F G 1990. 'Recent Observations on the Tower of Holy Trinity Church, Bosham', *Sussex Archaeological Collections* **128**, 55–72

Balson, P 1999. 'The Lenham Beds', in L P Thomas (ed), *British Tertiary Stratigraphy*, Geological Conservation Rev Ser 15, 243–52

Berg, M and Jones, H 2009. *Norman Churches in the Canterbury Diocese*, Stroud, The History Press.

British Geological Survey 1982. [map] *Canterbury* sheet 289 solid and drift edition. [surveyed 1938–55]

British Geological Survey 1974. [map] *Folkestone and Dover* sheet 305/306 solid and drift edition. [surveyed 1951–56]

English Heritage 2011. *A Building Stone Atlas of Kent*, Strategic Stone Study, English Heritage

Gale, A 2019. *The Isle of Wight,* Geologists' Association Guide 60, London

Gossling, F and Woolridge, S W 1926. 'On outliers of Lenham Beds at Sanderstead, Surrey', *Proc Geologists' Association*, **37**, 92–101

Hayward, K M J 2009. *Roman Quarrying and Stone Supply on the Periphery — Southern England. A geological study of first-century funerary monuments and monumental architecture*, Oxford, BAR 500

Hutchinson, J N 1969. 'A reconsideration of the coastal landslides at Folkestone Warren, Kent', *Geotechniques,* **19**, 5–38

Hutchinson, J N, Bromhead, E N and Lupini, J F 1980. 'Additional observations on the Folkestone Warren landslides', *Quart J Engineering Geology*, **13**, 1–31

Hutchinson, J N, Poole, C, Lambert, N and Bromhead, E N 1985. 'Combined archaeological and geotechnical investigations of the Roman fort at Lympne, Kent', *Britannia*, **16**, 209–36, pls

Jones, D K C 1999. 'Evolving models of the Tertiary evolutionary geomorphology of southern England, with special reference to the Chalklands', in Smith *et al*, 1–23

Jope, E M 1964. 'The Saxon building stone industry in southern and midland England', *Medieval Archaeol,* **8**, 91–118

Newman, J 1969, *The Buildings of England: North East and East Kent*, ed N Pevsner

Parsons, D (ed), 1990. *Stone: quarrying and building in England AD 43–1525*, Chichester

Richardson, A and Parfitt, K 2021. *East Wear Bay, Folkestone. Archaeological conservation management plan January 2021,* Canterbury

Secker, D nd, *c* 2010. *SS Mary and Ethelburga, Lyminge*: [unpublished] notes

Secker, D 2016. 'The late-Saxon and early romanesque churches at St Mary, Prittlewell, Essex', *Medieval Archaeol*, **60**, 115–36

Smart, J G O, Bisson, G and Worssam, B C 1966. *Geology of the Country around Canterbury and Folkestone*, Memoir of the Geological Survey of Great Britain

Smith, B J, Whalley, W B and Warke, P A (eds), 1999. *Uplift, Erosion and Stability: perspectives on long-term landscape development,* Geol Soc Special Publ, 162

Tatton-Brown, T 1991. *St Mary & St Ethelburga Church, Lyminge TR 1610 4085,* Canterbury Diocese: Historical and Archaeological Survey

Tatton-Brown, T 2006. 'A new survey of the fabric of the church of the Holy Trinity, Bosham, W Sussex', *Sussex Archaeol Colls,* **114**, 129–54

Worssam, B C 1963. *Geology of the Country around Maidstone*, Memoir of the Geological Survey of Great Britain

Worssam, B C and Tatton-Brown, T 1993. 'Kentish Rag and other Kent building stones', *Archaeol Cantiana*, **112**, 93–125

RADIOCARBON DATING AND CHRONOLOGICAL MODELLING OF SETTLEMENT CONTEXTS FROM LYMINGE

Peter Marshall

Eighteen radiocarbon results have been obtained from charred plant material and faunal remains recovered from excavations on Tayne Field and associated with monastic activity at Lyminge. Details of the dated samples, radiocarbon ages, and associated stable isotopic measurements are provided in Table RC1. The radiocarbon results are conventional radiocarbon ages (Stuiver and Polach 1977), corrected for fractionation using $\delta^{13}C$ values measured by AMS.

Seventeen samples were dated at the Oxford Radiocarbon Accelerator Unit (ORAU) in 2015 and 2021. Samples of bone and carbonised cereal grains processed at Oxford were pre-treated and combusted as described in Brock *et al* (2010), graphitised (Dee and Bronk Ramsey 2000) and dated by Accelerator Mass Spectrometry (AMS) (Bronk Ramsey *et al* 2004). The single bone sample dated at the Scottish Universities Environmental Research Centre (SUERC) in 2010 was pre-treated, combusted, graphitised, and dated by AMS followed the methods outlined in Dunbar *et al* (2016)

The chronological model, including both radiocarbon and coin dates for monastic activity and that taking place on Tayne Filed has been constructed using the program OxCal v4.4 (Bronk Ramsey 2009; Bronk Ramsey and Lee 2013) and the atmospheric calibration curve for the northern hemisphere published by Reimer *et al* (2020). The algorithms used are defined exactly by the brackets and OxCal keywords on the left-hand side of Figure RC1 (*http://c14.arch.ox.ac.uk/).* The posterior density estimates output by the model are shown in black, with the unconstrained calibrated radiocarbon dates shown in outline. The other distributions correspond to aspects of the model. For example, the distribution '*start_Tayne_Field*' (Fig RC1) is the posterior density estimate for the date when activity on Tayne Field began. In the text and Table RC1, the Highest Posterior Density intervals of the posterior density estimates are given in italics.

Given that four of the dated animals and the single human from the monastic phase of activity all show clear evidence for having a considerable marine/freshwater component in their diets (Fig RC2), we have only included these dates as providing *termini post quos* for their contexts in the model shown in Figure RC1. The overlapping (Fig RC1) model (Buck *et al* 1992) assumes that the two dated phases of activity at Lyminge are 'independent', ie no assumption is made about any ordering. Within each phase of activity, we assume that the dated events are randomly sampled from a uniform distribution — that is a random scatter of events between a start boundary and an end boundary (see Bayliss *et al* 2007 for further details). The model has good overall agreement (Amodel: 98) and suggest that monastic activity started in *445–775 cal AD at 95 per cent probability*; *start_monastic*; (Fig RC1), probably *645–765 cal AD at 68 per cent probability,* and finished in *835–1120 cal AD at 95 per cent probability*; *end_monastic*; (Fig RC1), probably *840–920 cal AD at 68 per cent probability*. Activity on Tayne Field is estimated to have begun in 800–980 *cal AD* at 95% probability; start_tayne_field; (Fig RC1), probably 875–960 *cal AD at 68 per cent probability*, and ended in *1055–1290 cal AD* at *95 per cent probability*; *end_tayne_field*; (Fig RC1), probably *1100–1220 cal AD* at *68 per cent probability*. The probability that monastic activity ended before the start of activity on Tayne Field (Fig RC3) is *54.4 per cent* with the gap estimated to be −50 to 95 years (*68 per cent probability*; Fig RC4), with this activity probably ending before the close of the ninth century (*59.5 per cent probability*, *end_monastic* < *AD* 900).

REFERENCES

Brock, F, Higham, T, Ditchfield, P and Bronk Ramsey, C 2010. 'Current pretreatment methods for AMS radiocarbon dating at the Oxford Radiocarbon Accelerator Unit (ORAU)', *Radiocarbon,* **52**, 103–12

Bronk Ramsey, C 2009. 'Bayesian analysis of radiocarbon dates', *Radiocarbon,* **51**, 337–60

Bronk Ramsey, C and Lee, S 2013. 'Recent and planned developments of the program OxCal', *Radiocarbon*, **55**, 720–30

Bronk Ramsey, C, Ditchfield, P and Humm, M 2004. 'AMS methods and developments — using a gas ion source for radiocarbon AMS and GC-AMS', *Radiocarbon*, **46**, 25–33

Buck, C E, Litton, C D and Smith, A F M 1992. 'Calibration of radiocarbon results pertaining to related archaeological events', *J Archaeol Sci*, **19**, 497–512

Dee, M and Bronk Ramsey, C 2000. 'Refinement of graphite target production at ORAU', *Nuclear Instruments Meth Physics Res B*, **172**, 449–53

Dunbar, E, Cook G T, Naysmith P, Tipney, B G and Xu, S 2016. 'AMS ^{14}C dating at the Scottish Universities Environmental Research Centre (SUERC) Radiocarbon Dating Laboratory', *Radiocarbon*, **58**, 9–23

Knapp, Z 2008. 'The Zooarchaeology of the Anglo-Saxon Christian Conversion: Lyminge, a case study', unpublished PhD thesis, University of Reading.

Reimer, P J, Austin, W E N, Bard, E, Bayliss, A, Blackwell, P G, Bronk Ramsey, C, Butzin, M, Cheng, H, Edwards, R L, Friedrich, M, Grootes, P M, Guilderson, T P, Hajdas, I, Heaton, T J, Hogg, A G, Hughen, K A, Kromer, B, Manning, S W, Muscheler, R, Palmer, J G, Pearson, C, van der Plicht, J, Reimer, R W, Richards, D A, Scott, E M, Southon, J R, Turney, C S M, Wacker, L, Adolphi, F, Büntgen, U, Capano, M, Fahrni, S M, Fogtmann-Schulz, A, Friedrich, R, Köhler, P, Kudsk, S, Miyake, F, Olsen, J, Reinig, F, Sakamoto, M, Sookdeo, A and Talamo, S 2020. 'The IntCal20 northern hemisphere radiocarbon age calibration curve (0–55 cal kBP)', *Radiocarbon*, **64**, 725–57

Stuiver, M and Polach, H A 1977. 'Discussion reporting of ^{14}C data', *Radiocarbon*, **19**, 355–63

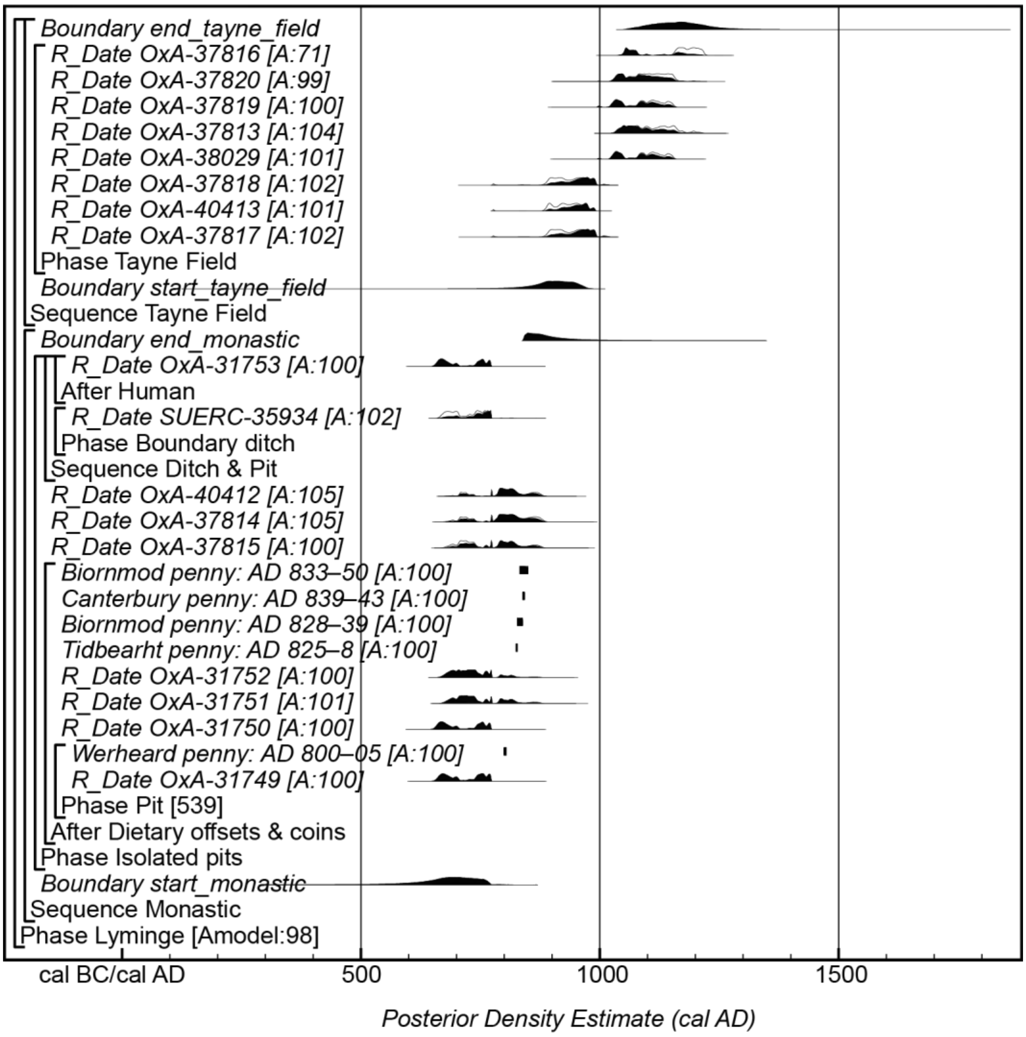


Figure RC1. Probability distributions of dates from Lyminge. Each distribution represents the relative probability that an event occurs at a particular time. For each of the dates two distributions have been plotted: one in outline, which is the result of simple radiocarbon calibration, and a solid one, based on the chronological model used. The large square brackets down the left-hand side of the figure along with the OxCal keywords define the overall model exactly.

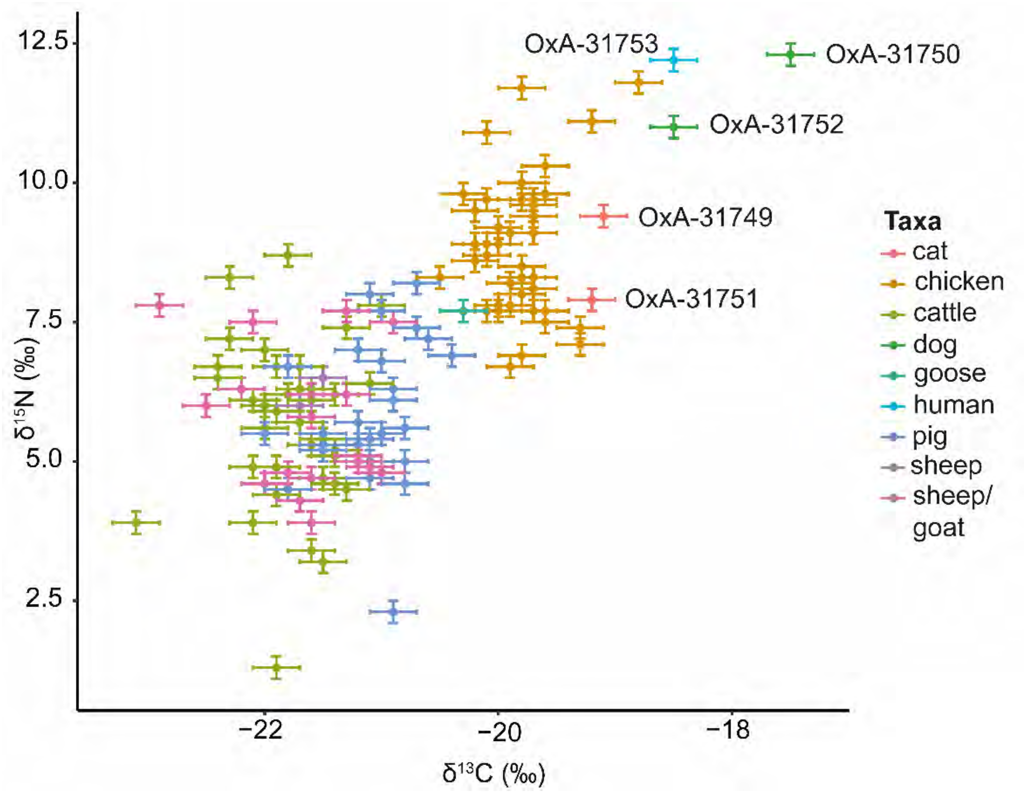


Figure RC2. Lyminge $\delta^{13}C$ and $\delta^{15}N$ isotope values (additional data from Knapp 2018)

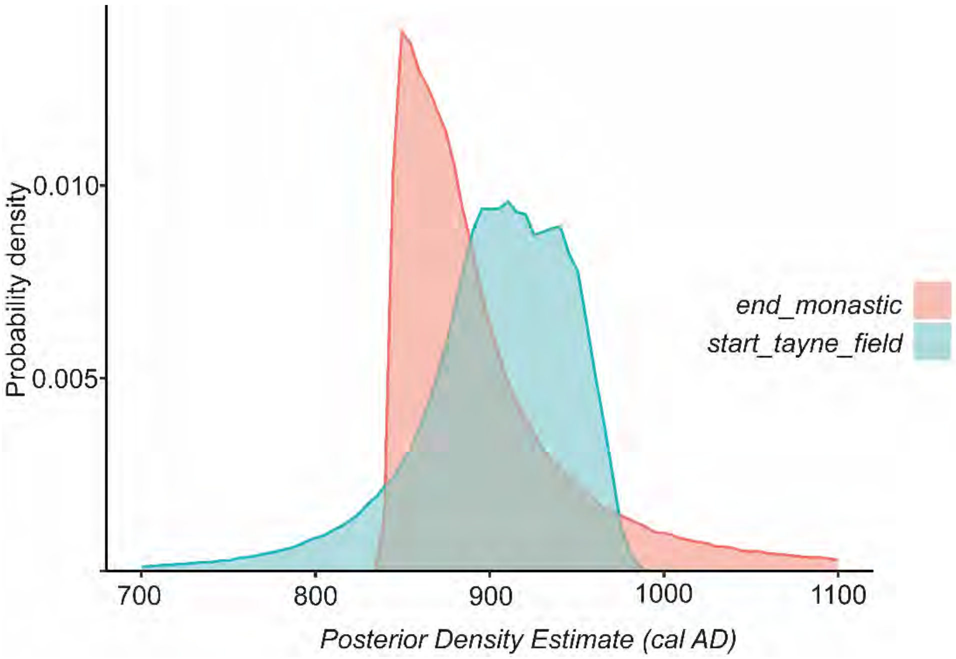


Figure RC3. Probability distributions of dates for the end of monastic activity and the start of activity on Tayne Field (note some of the tails of these distributions have been truncated to enable detailed examination of the highest area of probability) derived from the model described in Figure RC1.

Laboratory number	**Material and context**	**$\delta^{13}C_{IRMS}$ (‰)**	**$\delta^{15}N_{IRMS}$ (‰)**	**C/N ratio**	**Radiocarbon age (BP)**
Monastic activity					
OxA-31749	Animal bone, *Felis catus*, right femur from primary fill (656) of pit [539]	−19.1±0.2	9.4±0.3	3.3	1313±26
OxA-31750	Animal bone, *Canis lupus familiaris*, right femur from uppermost fill (11) of pit [12]	−17.5±0.2	12.3±0.3	3.4	1322±27
OxA-31751	Animal bone, *Felis catus*, right humerus from primary fill (197) of pit [125]	−19.2±0.2	7.9±0.3	3.4	1254±25
OxA-31752	Animal bone, *Canis lupus familiaris*, right femur from secondary fill (1506) of pit [1064]	−18.5±0.2	11.0±0.3	3.4	1267±25
OxA-31753	Human bone, left tibia from tertiary fill (1672) of pit [1663]	−18.5±0.2	12.2±0.3	3.3	1322±26
SUERC-35934	Animal bone, cattle, first cervical vertebrae (butchered) from primary fill (1820) of boundary ditch	−21.7±0.2	6.7±0.3	3.3	1291±20
OxA-37815	Carbonised grain, *Secale cereal* L., from fill (233) of pit [47], environmental bulk sample <30>	−23.1±0.2	–	–	1242±26
OxA-37814	Carbonised grain, *Avena* L., from fill (270) of pit [49], environmental bulk sample <24>	−25.8±0.2	–	–	1226±27
OxA-40412	Carbonised grain, *Avena* L., from fill (164) of pit [71], environmental bulk sample <5>	−22.3±0.2	–	–	1227±18
Tayne Field					
OxA-37817	Carbonised grain, *Triticum* L., from fill (3535) of pit [3264], environmental bulk sample <38>	−22.5±0.2	–	–	1109±26
OxA-40413	Carbonised grain, *Triticum* L., from fill (3539) of pit [3054], environmental bulk sample <40>	−23.9±0.2	–	–	1126±18
OxA-37818	Carbonised grain, from fill (3641) of pit [3264], environmental bulk sample <42>	−23.0±0.2	–	–	1112±26
OxA-38029	Carbonised grain, *Triticum* L., from fill (9374) of pit [9102], environmental bulk sample <31>	−22.2±0.2	–	–	972±24
OxA-37813	Carbonised grain, *Triticum* L., from primary fill (9395), of pit [9394] environmental bulk sample <44>	−23.5±0.2	–	–	929±27

OxA-37819	Carbonised grain, *Hordeum vulgare* L., from a dumped burnt-grain deposit (6764) in ditch [6599], environmental bulk sample <27>	−22.2±0.2	–	–	972±27
OxA-37820	Carbonised grain, *Triticum* L., from a dumped burnt-grain deposit (6745) in ditch [6553]. environmental bulk sample <24>	−24.1±0.2	–	–	950±27
OxA-37816	Carbonised grain, *Triticum* L., from a charcoal lens within the primary fill (9397) of pit [9375], environmental bulk sample <42>	−24.0±0.2	–	–	883±27

Table RC1. Radiocarbon and stable isotopes from Lyminge (Tayne Field and associated with monastic activity)

ASSESSMENT OF CHARRED AND MINERAL-REPLACED BIOTA FROM LYMINGE (LYM12 LYM13)

Rachel Ballantyne, 13th July 2014

INTRODUCTION

This report forms the second phase of interim assessment of the charred and mineral-replaced biota at the early monastic community of Lyminge, Kent (Thomas 2013). The 1623 litres of sediment represent 147 samples, which subdivide into: 6 of flint scatters, 36 of 6th century sunken-featured buildings (henceforth SFBs), 34 of 7th century timber hall features, 23 other 7th century pits and postholes, 34 of 12/13th Century settlement features, 11 of medieval features and 3 of an unphased double posthole sequence. In contrast, the previous assessment by Campbell (2012) covered 339 samples, which derived from one Middle Bronze Age vessel, many 6th–7th century settlement features and many 8th–9th century settlement features.

The research questions addressed broadly follow those outlined by Campbell (2012):

- What types of crops were being utilised at the site and how does this vary over time?
- What crop processing activities may have taken place within the excavation areas?
- ls there any evidence for long-distance trade, such as imported fruit or spices?
- What is the nature of the charcoal assemblage and what information might it provide on fuel use and the use of timber in construction?
- Is there variation between assemblages from the same context (intra-context variation) and between different contexts types and features (inter-context variation)?
- What biological evidence is there for refuse types and refuse management, particularly in the pit fills?
- How do the plant remains from Lyminge compare to other assemblages of the same period, especially Bishopstone, East Sussex?

METHODS

Bulk samples were processed by flotation for the recovery of plant remains, charcoal, and mineral-replaced biota, as well as molluscs, small animal bone and artefacts where present. A modified version of the Sīraf tank was used (Williams 1973) with flots collected on 300µm sieves and the heavy residues on 1mm mesh. The flotation and residue sorting were undertaken on-site during the excavations.

Flots have been scanned under a Leica MS5 (x6.3–x50) binocular microscope at the Pitt-Rivers Laboratory for Bioarchaeology, Division of Archaeology, University of Cambridge. All the identified charred plant remains and mineral-replaced biota are presented at the end of this report in Table 1. Nomenclature follows Stace (1997) for most plants, with the traditional nomenclature in Zohary and Hopf (2000, 28, Tables 3 and 65) for cereals. The recording system uses the groups: 1 present, 2 frequent, 3 common, 4 abundant, 5 superabundant.

RESULTS

?Prehistoric

Six samples represent possible prehistoric flint scatters **3828**, **3829**, **3830**, **3836** (2 samples) and fill **6701** of a possible Bronze Age posthole. All of the flint scatters include one charred grain; there is free-threshing wheat in **3828**, barley in **3829**, wheat in **3830** and an indeterminate grain in **3836**. There are also occasional charred seeds, with apple/pear (*Malus*/*Pyrus* sp.) in **3828** and stinking mayweed (*Anthemis cotula*) and cat's-tail (*Phleum* sp.) in **3830**. The posthole contains no charred macrofossils. All these samples have only low amounts of highly fragmented charcoal.

The few charred macrofossils in the ?prehistoric flint scatters may be intrusive from during or after the 3rd/4th centuries AD, unless the flint scatters themselves also prove to be later in date. Firstly, the seed of stinking mayweed (*Anthemis cotula*) in scatter **3830** is unusual as this plant is often associated with cultivation of heavy clay soils following the late Roman introduction of the mouldboard plough (Jones 1988). Secondly, whilst free-threshing wheat grain and an apple/pear seed in **3828** could be characteristically Neolithic to Early Bronze Age in date (see Grieg 1991); they could also be linked with the early medieval activity at Lyminge, which has similar remains (e.g. free-threshing wheat grains in many samples, and mineral-replaced apple/pear seeds in **3673** and **3697**).

Anglo-Saxon Phase 1 (6th Century)

Thirty six samples represent three sunken-featured buildings (henceforth SFBS), with the fills excavated in spits. One further sample, <68> **6816** from **SFB6**, was not sent for assessment.

SFB5 has 7 samples from:

- spit 3 fills **3704** (NE quadrant) and **3729** (SW quadrant)
- spit 4 fill **3705** (2 samples, both NE quadrant)
- spit 6 **3707** (NE quadrant) and **3734** (SW quadrant)
- spit 7 **3708** (NE quadrant)

Charcoal increases in abundance with depth, becoming superabundant and well preserved by **3708**. Where spits have samples from both the NE and SW quadrants, there is a bias towards the SW quadrants – spit 6 has charcoal superabundance in **3734** but only abundance in **3707** and similarly for spit 3, **3729** has charcoal abundance whilst in **3704** it is common.

The NE–SW gradient in charcoal abundance may reflect charcoal deposits near to SFB5 which subsequently became eroded or reworked post-use into the pit fills. Alternatively, the fill compositions may reflect the ash 'shadow' of a hearth sited on a floor above the pit. Qualities of the fill stratigraphy, including its micromorphology, and surrounding features should reveal which explanation is more likely.

The charred plant macrofossils in SFB 5 do not have any clear patterning, which is probably linked to their sporadic distribution in very low quantities. Barley grain predominates in all the samples, and where well preserved is hulled and occasionally twisted, indicating a hulled 6-rowed variety. **3708** includes a free-threshing wheat grain and **3729** has an indeterminate wheat grain. There is a single oat seed (wild or cultivated) in **3704**. Other charred plants include a likely pea cotyledon in **3734** and a pea/bean cotyledon fragment in **3704**. There are no charred cereal chaff items or wild plant seeds.

Low quantities of mineral-replaced biota occur in all but two samples (**3704** and one from **3705**), suggesting that concentrations of organic matter were once present in many of the fills. The quantity and range of mineral-replaced biota is greater with depth, which may be a function of geochemistry (greater moisture at depth, and percolation of mineral salts down the profile) rather than a simple correlate for greater quantities of organic material in the lower fills. **3708** has two mineral-replaced seeds of a goosefoot type (Chenopodiaceae indet.) and one of black nightshade (*Solanum nigrum*), whilst **3734** has amorphous fragments of calcium phosphate concretion that may represent coprolites. Both goosefoot and black nightshade thrive on disturbed, nutrient-enriched soils, including on farmland and settlements; so it is unclear whether these seeds were defecated by humans or animals, or were seeds from nearby plants (after Campbell and Kenward 2012). 'Mystery objects' (Carruthers 1989; JISCMail Archaeobotany archives, May 2011), probably mineral-replaced fungal sclerotia, occur in **3705**, **3707**, **3708** and earthworm cocoons occur in **3705** and in **3729**.

Of note in **3705** sample <32> are numerous blackened shells of possible Hydrobiidae indet.; tiny snails of muddy water that, depending on the precise species, may be freshwater, brackish or saltwater. The shell blackening may be from charring or from peat staining, and the associated charred plant remains do not provide any further clues as to origin. The shells may be linked to burnt turf of peat, or debris from the processing of edible seashells – closer taxonomic identification should provide clarification. Sample <35> also from **3705** contains no such shells, suggesting those in <32> represent a small discrete deposit.

SFB6 has 14 samples from:

spit 1 deposits **6801** (exterior), **6826** (interior and exterior samples)

spit 2 deposits **6805** (interior), **6806** (exterior), **6830** and **6834** (both interior wall trench fills), **6835** (exterior)

spit 3 fills **6809, 6811, 6812** (all NW quadrant)

spit 4 fills **6815** and **6816** (again NW quadrant).

Fills **6842** and **7012**

Charcoal occurs in lower quantities than for SFB5, being common in most samples but never abundant or superabundant. There is no apparent internal–external patterning. Fill **7012** appears to have the highest charcoal concentrations, but just has frequent charcoal as a 2L sample compared to the other 10L samples.

Interior wall trench **6834** has abundant, well preserved charred cereal grain which is 70% hulled barley with some twisted grains, and 30% wheat that is mostly free-threshing with 1 or 2 possible hulled grains. There are also 1 or 2 oat seeds (wild or cultivated). No cereal chaff or wild plant seeds appear present; however this context clearly merits more detailed analysis.

As with SFB5, barley predominates in all contexts with charred grain, and when well preserved is of a hulled type. **6805** and **6815** have frequent barley grain along with some free-threshing wheat, whilst **6830** has frequent barley grain with an oat seed. Most of the other contexts have 1 or 2 grain, usually of barley, and two contexts have no grain (**6801** and **6826**). There is also an unidentifiable large legume fragment in **6835** and individual wild plant seeds of stinking mayweed (*Anthemis cotula*) in **6801**, clover/medick (*Trifolium*/*Medicago*) in **6805**, fat hen (*Chenopodium album*), sheep's sorrel (*Rumex acetosella*) and meadow-grass (?*Poa*) in **6809**, orache (*Atriplex* sp.) in **6826** and nipplewort (*Lapsana communis*) in **7012**. These wild plants are all likely arable weeds whose seeds may have been included with the harvest, although their provenance remains uncertain with such low quantities of both grain and seeds.

There is a single mineral-replaced mystery item, probably a seed or fungal sclerotium, in **6801**.

SFB7 has 15 samples from:

spit 1 **6201** and **6226** (both contexts with interior and exterior samples)

spit 2 **6202**, **6229** (both contexts with interior and exterior samples) and **6230** (?interior)

spit 3 **6204** (interior and exterior, NE quadrant), **6223** (interior and exterior) and **6236** (central area, cut)

spit 4 **6207** (interior, NW quadrant).

The charcoal distribution is similar to that for SFB5, with a general increase in abundance by depth. Charcoal is superabundant in spit 3 contexts **6204** (interior and exterior), **6223** (interior) and **6236**. However underlying spit 4 context **6207** only has abundant charcoal, as does overlying spit 3 **6223** (exterior) and spit 2 contexts **6202** (exterior) and **6229** (interior and exterior). The other spit 2 contexts and all those from spit 1 have poor charcoal representation and overall there is no apparent internal–external patterning.

Charred plant macrofossils in SFB7 also show similar patterning to those in SFB5, with finds sporadic, low in quantity and with no clear patterning. Most remains are of 1 or 2 cereal grain, usually barley – this is the case in **6202** (exterior), **6204** (exterior), **6226** (interior), **6229** (exterior), **6230** and **6236**. Spit 1 contexts **6201** (interior) and **6226** (exterior) have wheat grain with no barley grain and are the only such examples from the SFB fills. However, as these are the upper fills of the SFB pit it is possible they represent later activity. Wheat grains, usually free-threshing, are more frequent than in the other SFBs as they co-occur with the barley grain in **6204**, **6226**, **6229** and **6236**. Spit 2 fill **6202** (interior) also includes a single poorly preserved free-threshing wheat rachis internode, the only cereal chaff from any SFB, so the better representation of wheat in SFB7 may be a real pattern. Oat seeds also occur in **6202** and **6204** (both exterior).

There are a few charred wild plant seeds in several of the fills, as with SFB6. Stinking mayweed (*Anthemis cotula*) and many-seeded goosefoot (*Chenopodium* cf. *polyspermum*) occur in spit 1 **6226** (interior and exterior), with dock (*Rumex* sp.) and clover (*Trifolium* sp.) in spit 2 **6202** (exterior), stinking mayweed and rye grass (?*Lolium* sp.) in spit 2 **6230** and two goosefoot seeds (*Chenopodium* sp.) in spit 4 **6207**. These are all possible arable weeds that may be linked to the grain.

Only spit 4 **6204** includes mineral-replaced biota, with several 'mystery items' (Carruthers 1989; Campbell 2012) that are either seeds or (more probably) fungal sclerotia, and a fragment of millipede exoskeleton. Some of the upper spits also contain tarry globules and vitrified charcoal that are likely to derive from an oven or kiln – although the precise pathway for vitrification is still unknown (McParland et al. 2010). The affected contexts are **6201** (interior and exterior), **6202** (interior and exterior) and **6226** (interior and exterior).

The 6th century SFB fills provide a broad indication of the range of cereals and pulses in use; however the often very low quantities of macrofossils preclude detailed spatial or temporal analyses or, for example, use of the wild plant seeds to interpret crop husbandry in any detail. There does however appear to be greater charcoal in the mid to lower spits of each SFB pit, which may prove a useful contrast with other lines of evidence such as the stratigraphy, micromorphology and other finds. Assemblages with systematic bulk sampling of 6th–7th century features continue to be rare in England, and those that do have low numbers of charred plant macrofossils, for example Carlton Colville, Suffolk (Ballantyne 2009).

Anglo-Saxon Phase 2 (7th Century)

There are 57 samples; 34 from structural features in the timber halls, 14 from pits and 9 from other postholes. One further sample, <153> **6687** from the wall trench of a timber hall was missing at assessment. The results are discussed below by broad feature type. As with the 6th century SFBs, charcoal is occasionally abundant however charred plant macrofossils and mineral-replaced biota are at best frequent (up to 10 items per sample).

The timber halls

Charcoal is only abundant in wall trench **3560** and cess pit upper fill **7164**. Other contexts where charcoal is common are pit fill **3427**, wall trenches **3805**, **6987**, **7209**, posthole **6524**, door post **7074** and cess fill **7288**. The remaining 25 contexts have low quantities of charcoal (recorded as either 'frequent' or 'present'). The actual charcoal concentrations are slightly more complicated than these records suggest, as sample volumes vary from 1–40L. Wall trench **3560** is thus particularly notable as the sample was only of 3.5L, yet contained abundant charcoal. Two contexts with common charcoal are also of note in this regard; pit fill **3427** (6.5L sample volume) and wall trench **3805** (4L sample volume).

Contexts with frequent charred grain (up to 10 items) are wall trenches **3560**, **6877**, **6987** and **7209**, posthole **6706** and cess fill **7288**. Barley usually predominates and when well preserved is hulled and sometimes twisted – indicating a hulled six-rowed variety. A single naked barley grain occurs in **7209**. Wheat grain co-occurs in most contexts and when well preserved is almost always identifiable as a free-threshing variety. There are single ?hulled wheat grains in post setting **6937** and wall trench **6842**. Posthole **6706** is unusual in containing wheat grain without any barley. There is a single rye grain in wall trench **6877**, and oat seeds are common across the samples but cannot be distinguished as cultivated or wild. A further fifteen contexts include 1 or 2 cereal grains that are poorly preserved and thus only identifiable as wheat or barley. Unfortunately there is no cereal chaff in any context to help verify the wheat grain identifications.

Other likely food plants are represented by single Celtic beans (*Vicia faba* var. *minor*) in wall trench **3560** and posthole **6524**, and a single charred ?pea (cf. *Pisum sativum*) in the upper fill of cess pit **7164**. There are also pea/bean fragments in posthole **6706** and wall trench **6814**.

Wild plant seeds are very infrequent, suggesting that crop processing was either carried out away from the timber halls, or that the by-products were not routinely charred. There are single seeds of cat's-tail (*Phleum* sp.) in posthole **3948** and door post **7038,** meadow grass (*Poa* sp.) in wall trenches **6987** and **6814**, mint (*Mentha* sp.) in plank ghost **7030** and goosefoot (Chenopodiaceae indet.) in plank slot **7136**. These numbers of seeds are too low to support any comment regarding the original materials or charring events represented.

Lower fill **7156** of a slag-filled pit is notable for containing numerous faunal remains in addition to amorphous calcium phosphate concretions with occasional grass stem (culm) fragments embedded in them. The many small ?mammal bones (e.g. rodents) and small fragments of larger mammal bones suggest that cat, dog or pig faeces may be present. There are numerous small fish vertebrae which include some of eel (*Anguilla anguilla*) and the mineral-replaced remains of millipede exoskeleton, a fly puparium, an earthworm cocoon, and a 'mystery object' likely to be a fungal sclerotium. It is highly possible that an admixture of refuse materials is present, so the presence of human faeces cannot be excluded although there is no direct evidence such as fruit or condiment seeds.

Wall trench **7209** includes shells of *Lymnaea*, marsh snails that are usually found on slow to still water and/or emergent vegetation. These shells could be from gathered water or clay, or a wetland plant used for thatching or strewing, such as reeds, club-rush or rushes.

Other features

A further five samples represent Anglo-Saxon phase 2 pits **3296**, **6766**, **6253**, posthole **6333** and slag fill **6965**, all of which include very low amounts of charred plant remains. Cereal grain is most abundant in pit **3296**, with less than ten hulled barley grains, one free-threshing wheat grain and a wild or cultivated oat seed. Single grains of free-threshing wheat occur in pit **6253** and slag fill **6965**, and a single unidentifiable grain fragment in posthole **6333**. Pulses are represented by a pea/bean fragment in slag fill **6965** and an unidentifiable cotyledon (seed half) fragment in posthole **6333**. There are few wild plant seeds, which are thus of uncertain significance, darnel (*Lolium* cf. *temulentum*) in pit **6253**, meadow grass (*Poa* sp.) in pit **6333**, hair-grass (*Aira* sp.) in pit **6766** and clover (*Trifolium* sp.) in slag fill 6965.

Anglo-Norman (12/13th Century)

The thirty-four samples represent thirty-one pit fills, two ditch fills (**3483** and **6429**), and posthole fill **3245**.

All of the sampled contexts contain charred cereal grain, which is occasionally abundant. Sixteen of the thirty-one pit fills (52%) include mineral-replaced remains, mostly segments of millipede exoskeleton or amorphous calcium phosphate concretions that are probably coprolitic, with occasional seeds, grass stem (culm) fragments, earthworm cocoons and fly puparia. The biota suggest that much of the decaying organic matter was vegetal in addition to human/animal faeces; e.g. bedding, fodder or strewing materials.

Good indicators of human faeces or putrefaction are relatively rare, such as likely ingested fruit/condiment seeds or the puparia of blow flies (Calliphoridae); however the relative lack of mineral-replaced fruit stones will in part be a function of the non-assessment of items collected from the heavy residues. Single apple/pear seeds (*Malus/Pyrus* sp.) occur in pit fills **3673** and **3697**. Likely condiment use is indicated by five cabbage/mustard seeds (*Brassica/Sinapis*) in pit fill **3463**, two in pit fill **3398** and one in pit fill **6387**. Cess pit **3484** appears confirmed by the presence of amorphous calcium phosphate concretions (likely coprolitic) and a puparium comparable to blow fly (Calliphoridae). Likely coprolitic, amorphous calcium phosphate concretions are also present in pit fills **3637**, **3639**, **3673** and **3893**.

Charred grain is abundant in pit fills **3535**, **3539**, **3641** and common in pit fills **3208**, **3525**, **3527**, **3665**. The range of cereals is consistent, with free-threshing wheat and hulled barley the main types, and sporadic very low quantities of wild/cultivated oats and rye. Free-threshing wheat grain is the main cereal in these grain-rich fills, except in **3535** and **3539** where hulled barley is instead predominant. Rye only occurs in fill **3208**, and wild/cultivated oats in fills **3535**, **3539**, **3641** and **3665**. Cereal chaff is rare and poorly preserved, so the wheat identifications cannot be refined – single free-threshing wheat rachis internodes occur in pit fills **3525**, **3641** and **3665** but are too fragmentary to identify as hexaploid or tetraploid types. A single free-threshing wheat rachis internode in grain-poor pit **6499** is clearly hexaploid, so bread wheat is confirmed during this period (*Triticum aestivum sensu lato*).

These seven grain-rich pit fills are likely to represent ash from a specific activity such as grain drying in preparation for storage or milling, or baking (Moffett 1994; Ballantyne 2010). There are few accompanying pulses, with possible single pea halves (cotyledons) in **3525** and **3539**. Wild plant seeds are also infrequent and in low numbers, suggesting that grain cleaning practices were highly efficient; correspondingly, there is almost no potential for the reconstruction of crop husbandry. Wild plants with 1 or 2 seeds from across the seven grain-rich pits are: goosefoot (*Chenopodium* sp.), dock (*Rumex* sp.), vetch/wild pea (*Vicia/Lathyrus* sp.), probable fool's parsley (cf. *Aethusa cynapium*), cat's-tail (*Phleum* sp.) and probable rye brome (*Bromus* cf. *secalinus*). All are potential arable weeds that also occur in a range of other habitats.

The twenty-seven other sampled pit, ditch and posthole fills have only low quantities of charred grain (up to 10 items) that are difficult to interpret as the grains are often poorly preserved and may be significantly displaced in time and space from the original charring contexts. Cess pit fills **3484** and **3639** are of note for including single well-preserved, elongate wheat grains with dorsal ridges comparable to the hulled type spelt wheat. However the identifications must be tentative as there no hulled wheat chaff has been noted in either the 2011 or 2012 assemblages. The wild plant seeds in these grain-poor fills are infrequent and low in number, with most taxa comparable to those for the grain-rich pit fills. One seed of stinking mayweed (*Anthemis cotula*) in **3667** suggests cultivation of heavier soils, probably with a mouldboard plough, for which this species is regarded as an indicator (Jones 1988).

Medieval

The eleven samples from Anglo-Norman/Medieval or Medieval features represent eight ditch fills and three pit fills. Three ditch fills contain superabundant charred cereal grain, whilst four ditch fills and one pit contain low to moderate charred grain. In contrast ditch fill **3144** and pit fills **6304** and **6316** lack all charred remains other than low amounts of charcoal. Mineral-replaced biota are absent from all the sampled contexts.

Charred cereal grain is superabundant in ditch fills **6594**, **6745** and **6764**, where it appears to represent ash from a single source; perhaps a grain-drying or baking oven. There are broadly equal quantities of hulled barley and free-threshing wheat grains, with occasional rye and oats. Cereal chaff refines the identifications further, with a six-rowed barley rachis internode in **6594** and two articulated rivet wheat rachis internodes (tetraploid, *Triticum turgidum sensu lato*) in **6745**. Many other chaff items are fragmentary and not identifiable further – up to fifty free-threshing wheat rachis internodes in **6594** and an unquantified number in **6745**. Low amounts of brushwood charcoal (roundwood) and cereal straw (culm nodes) are also consistent with oven ash (Marguerie and Hunot 2007, 1425; Moffett 1994).

There are a moderate number (10+) of peas (*Pisum sativum*) and Celtic beans (*Vicia faba* var. *minor*) in grain-rich fill **6594**, with the identifications confirmed by good survival of the attachment scars (hila). A few peas are also present in **6745**, whilst likely peas/beans occur in **6764** but are poorly preserved. There are few other seeds, mostly probable arable weeds with grain-sized seeds that are hard to remove from the crop; darnel (*Lolium temulentum*) and seed capsules of wild radish (*Raphanus raphanistrum*). Cabbage/mustard seeds in **6594** and **6745** are probably of a weedy type such as charlock (*Sinapis arvensis*), although they could represent cultivars. A single stinking mayweed seed (*Anthemis cotula*) in **6745** suggests cultivation of heavy clay soils.

Of the samples with low to moderate charred grain, ditch fill **3248** contains similar material to the three grain-rich ditch fills above, with free-threshing wheat grain, indeterminate grain, a pea and a darnel seed. Ditch fills **3101**, **6306**, **6661** and pit **6578** also include a few grains and seeds of uncertain significance.

Double post hole sequence (unphased)

Three samples representing posthole fills **6093**, **6105**, **6107** have produced very limited results, with two barley grains in **6093** and a barley, an oat and an unidentifiable grain in **6107**. Single clover seeds (*Trifolium* sp.) are also present in these two fills, whilst **6105** includes a vetch/wild pea seed (*Vicia/Lathyrus* sp.).

INTERPRETATION

The range of economic and wild plants in the samples from 2012–13 is comparable to those identified by Campbell (2012) for the 2008–10 excavations.

Charred cereal grain predominates, with hulled six-rowed barley, free-threshing wheat and sporadic hulled wheat, oats and rye. The wheat identifications are tentative as there is little accompanying chaff, which is a more reliable indicator of taxon than grain. Bread wheat (a hexaploid free-threshing wheat) is only confirmed by chaff in 12th/13th century pit fill **6499**, whilst rivet wheat (a tetraploid free-threshing wheat) is only confirmed by chaff in medieval ditch fill **6745**. There is no hulled wheat chaff and likely hulled wheat grain occurs only as 1–2 items in several Anglo-Saxon and Anglo-Norman features. Germinated grain is very infrequent as so there is no good evidence for malting as opposed to natural grain wastage.

Hulled wheats (in Britain, usually emmer and spelt) are more characteristic of the prehistoric to very early medieval periods, although there is growing evidence for their later medieval cultivation (Greig 1991; Pelling and Robinson 1998; Ballantyne 2010). Whilst the few well preserved grains are elongate and with clear dorsal ridges, there is no hulled wheat chaff to confirm their identification as hulled wheat. It is thus unclear whether these few grains represent actual crops, naturalised (feral) populations growing as weeds, or free-threshing wheat grains exhibiting 'speltoid' traits (see Campbell 2012). In contrast, chaff of bread wheat, rivet wheat and spelt (a hulled wheat) all occurred in 8th–9th century features (ibid.).

Peas and Celtic beans (a small type of broad bean) occur sporadically from the 6th century onwards however, there are no remains of flax in the 2012–13 samples (cf. Campbell 2012) and there are no exotics such as fig or grape. The low numbers of seeds of non-cereal cultivars and wild plants suggests that they were not routinely exposed to charring. In addition, there are few mineral-replaced fruit seeds or condiment seeds, although this should change when the heavy residue finds are examined by an archaeobotanist. Mineral-replaced apple/pear seeds and cabbage/mustard seeds occur in several 12th/13th century pit fills, but no samples as yet include the blackberry, elder, sloe or plum seeds recorded for 8th–9th century features (ibid.); on present evidence, those form a distinct, refuse- and faeces-rich phase of pit infilling at Lyminge. The

12th/13th Century pits examined here include limited evidence of human faeces (the fruit and condiment seeds noted above), but have relatively few fly puparia and other biota compared to the 8th–9th century pits.

Variation by phase and feature type

The majority of the 2012–13 samples contain low quantities of charcoal, charred grain, chaff, pulses, wild seeds and mineral-replaced biota.

Charred grain is only superabundant in two medieval ditch fills (**6594**, **6745**) and is abundant in SFB 6 fill **6834** and three 12/13th century pits (**3535**, **3539**, **3641**); these trends are shown in Figure 1(a) below. In contrast, charcoal is only superabundant in SFB 5 (fills **3708**, **3734**) and is also abundant in SFB 5 (fills **3705**, **3729**, **3707**), SFB 7 (fills **6233**, **6236**, **6204**x2), two 7th century timber hall features (**3560**, **7164**), 12/13th century pit **3527** and medieval ditch fill **6745**; this pattern is illustrated in Figure 1(b) below. The numerical values in each chart are identical to those presented in Table 1 at the end of this report:

1 present 2 frequent 3 common 4 abundant 5 superabundant

Charred chaff, pulses and wild seeds are never abundant or superabundant and so are not illustrated by trend charts. Only medieval ditch fills **6594** and **6745** have more than 10 chaff items, and **6594** is also the only context with more than 10 pulses. No context has more than 10 wild seeds.

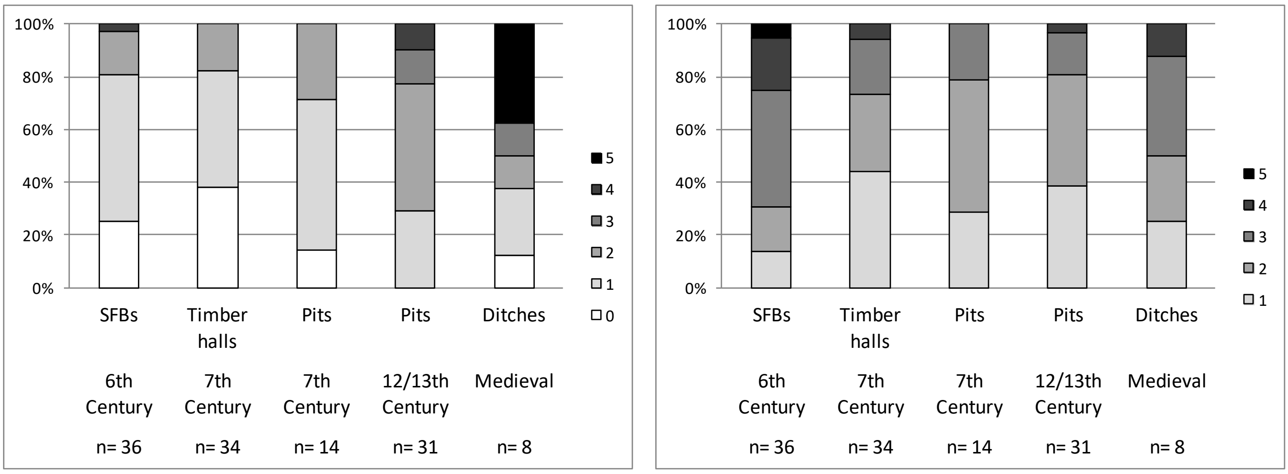


Figure 1: Abundance of (a) cereal grain and (b) charcoal for major feature groups in 2012 and 2013
'n' refers to the number of samples within each feature group

It is striking that there are opposing temporal trends for charred grain and charcoal, with grain best preserved in medieval dumps of apparent grain-drying oven ash, whilst charcoal is best preserved in the 6th Century SFB fills. The very good preservation of charcoal in the SFB fills suggests that these deposits formed either temporally or spatially close to their origin; rapid dumps and/or from nearby hearths, hence the good preservation. The low quantities of grain and charcoal in the 7th Century and 12/13th Century features suggests those remains are more displaced temporally and/or spatially from their charring origin; arriving via diffuse surface debris or middens. These interpretations are conjectural and require reconsideration at the full analysis stage, with complimentary lines of evidence from other artefact classes and the stratigraphy, to establish the influence of likely original charring events (e.g. activities and the materials selected) *versus* formation processes (e.g. rapidity of deposition and thus fragmentation).

Campbell (2012) has noted that barley tends to occur in a higher proportion of 6th–7th Century samples compared, whilst in 8th–9th Century samples wheat occurs in more samples than barley. This trait is explored in more detail in Figure 2, where the previous results are combined with those for the 2012–13 samples.

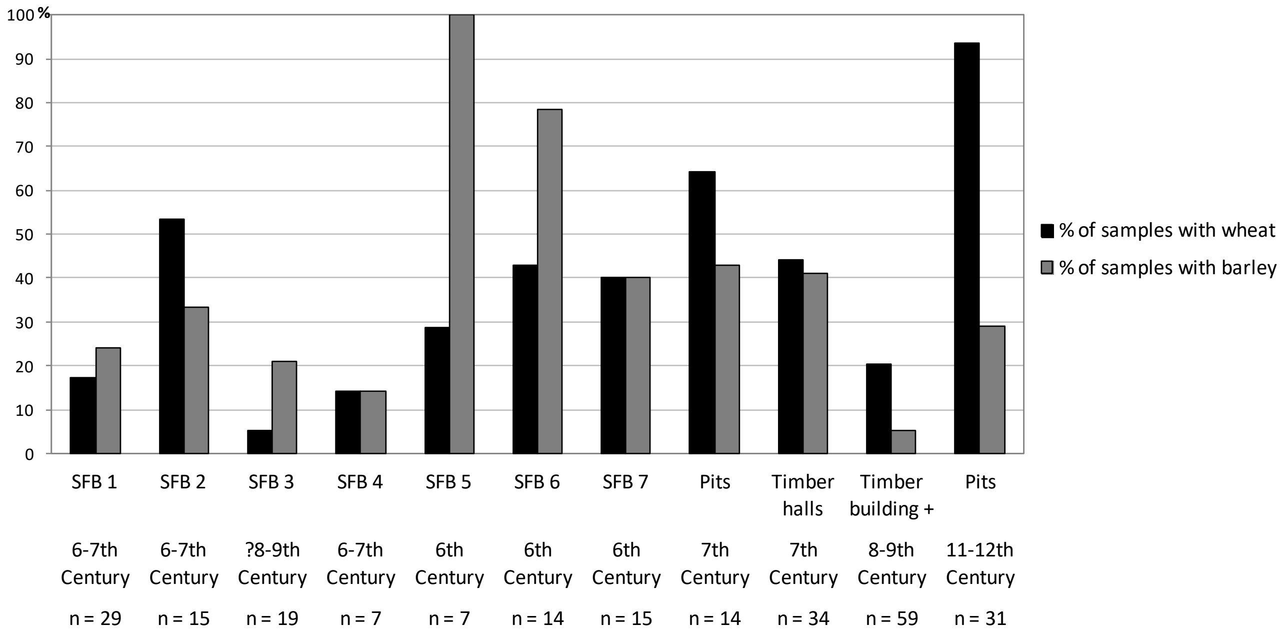


Figure 2: Incidence of wheat and barley remains across major feature groups, 2008–12 excavations
'n' refers to the number of samples within each feature group

There is much variety in the representation of wheat and barley in the SFBs, probably linked to the lower numbers of samples. Barley is more frequent than wheat in SFB 1, SFB3, SFB 5 and SFB 6, and has parity with wheat in SFB 4 and SFB 7. Whilst SFB 3 has been suggested as potentially 8th–9th Century in date, it is illustrated alongside the other SFBs in Figure 2 as, if the dating is correct, it is the only post-6th Century feature group where barley is more frequent in samples than wheat.

Crop husbandry

As noted earlier, wild plant seeds are either absent or in low quantities in all samples and so there is very limited potential for the reconstruction of crop husbandry from likely arable weeds. Only one seed type is an 'indicator plant'; stinking mayweed (*Anthemis cotula*), which occurs as a single seeds in flint scatter **3830**, SFB 6 **6801** and SFB 7 **6226 6230**, 12/13th Century pit **3667** and medieval ditch **6745**. A single seed also occurs in 8th–9th Century timber hall fill **2560** (Campbell 2012). This plant has been linked to cultivation of heavy clay soils following the late Roman introduction of the mouldboard plough (Jones 1988). Other seed types are too infrequent and few in number to be informative, such as goosefoots (Chenopodiaceae), which thrive on nitrogen-rich or manured soils, and clovers (*Trifolium* sp.), which as legumes have an adaptive advantage of nitrogen-poor soils.

Pits, refuse and the living environment

Whilst mineral-replaced biota do occur in low quantities in the 6th Century SFB fills, these remains are of millipede exoskeleton, earthworm cocoons, 'mystery objects' (after Carruthers 1989) thought here to be likely fungal sclerotia, and very occasional wild seeds of uncertain significance such as goosefoots (Chenopodiaceae) and black nightshade (*Solanum nigrum*). The presence of calcium phosphate in itself indicates past concentrations of decaying organic matter (McCobb et al. 2001), whilst the range of biota is consistent with decaying vegetal materials rather than the faeces- and refuse-rich fills of later phases.

The low numbers of fly puparia in the 12th/13th century pits suggests that these features provided fewer opportunities for colonisation or mineral-replacement than the 8th–9th century pits examined by Campbell

(2012). The 12th/13th Century pits may have been filled and/or sealed more rapidly, or have contained a range of refuse types less conducive to mineral-replacement.

It is worth considering whether during the 8th–12th centuries there was a shift from long to short 'refuse lives' for the materials deposited into the pits. At later Anglo-Saxon Bishopstone (Ballantyne 2010), patterns between the charred and mineral-replaced biota in individual pits suggested that refuse had first accumulated as surface middens or spreads, perhaps mixed further and defecated by scavengers such as pigs, dogs and rodents, prior to redeposition into the pits. The assessment data from Campbell (2012) and this reports suggests that the 8th–9th century pits at Lyminge contain good evidence for long 'refuse lives' compared to the less biologically-diverse 12th/13th century pit fills. These later pits contain no examples of small dung fly/frit fly puparia (Sphaeroceridae/Chloropidae types) that were sometimes abundant at Bishopstone (ibid., Table 7.11) although there is one blow fly puparium (Calliphoridae) in fill **3484**. The author has not seen the puparia in the 8th–9th century pits and so cannot comment on their types, simply the frequency of their occurrence and plurality of the remains (most 12/13th Century finds are of individuals).

Plant foods, economy and status

The range of plant types provides no simplistic indication of site status, for example by the presence of exotic types such as grape or fig seeds. All the identified cereals and pulses are found on a wide range of contemporary site types (Moffett 2011), and it is other facets of the assemblage that are likely to be more illuminating regarding past lifeways and the cultural identity of the inhabitants. For example, the abundance and distribution of charred grain may be indicative of ash from particular activities such as corn drying ovens, which represents a specialisation linked to increasing the efficiency of grain storage or milling. The range of mineral-replaced biota and their temporal and spatial distributions are important indicators of past activities and attitudes to refuse management. On present evidence, the 8–9th Century was a distinct, refuse-rich period of pit infilling, possibly with redeposition from surface middens, perhaps replaced by direct pit infilling by the 12/13th Centuries.

CONCLUSIONS

This assemblage is of national significance for understanding social change during the 6th–12th Centuries AD due to its temporal breadth and association with the emergence of the early monastic community at Lyminge. In particular, the juxtaposition of charred and mineral-replaced biota offers a route into past lifeways and their material remains. As noted by Campbell (2012) and Van der Veen et al. (2013), there are still few systematically sampled sites from the 6th–9th Centuries in England, and even fewer where the assemblages are not complicated by underlying Roman period deposits. These factors mean that despite the often low quantities of plant macrofossils, charcoal and invertebrates, there is high potential for a significant contribution to knowledge.

RECOMMENDATIONS

The final season of excavation in 2014

The current, intensive bulk sampling strategy should continue in the final season, to ensure comparability across the all the different phases and feature types.

Particular attention should be given to heavy residue sorting for mineral-replaced biota that do not routinely enter flots during flotation. Greater than 4mm residue fractions may be reliably sorted by eye for fruit stones. However it is crucial that samples with mineral-replaced items greater than 4mm should have their 1–4mm fractions sorted by an appropriately skilled person using magnification. If necessary, for reasons of time or skilled labour, these 1–4mm residues may need to be kept to allow a specialist to sort them off-site at a later date. Many crucial items in those 1–4 mm residues may be too small or indistinct (e.g. fig seeds, or invertebrate eggs/puparia) to be identifiable residue to a non-specialist with or without magnification.

The high relevance of the mineral-replaced assemblage to key questions regarding diet, status and refuse management means that the heavy residues are of high importance for characterising the site, and thus worthy of extra time and resources during sorting. Amorphous concretions of calcium phosphate are worth keeping from the residues as these are often coprolitic and when disaggregated can contain microfossils such as cereal bran, mammalian hairs, and bone fragments, depending on the originating species (e.g. Bell and Dickson 1989). Coprolites are also increasingly used for biomolecular analysis, such as the investigation of sterols to identify their content and origins (Shilito et al 2011). Finally, if distinct cess pits or latrines are encountered during the final season of excavation, it should be considered whether small sediment samples (c.50ml) should also be collected for palaeoparasitic analysis.

Post-excavation analyses

Full analysis is merited by abundance or superabundance of remains in 13 charcoal-rich samples and 7 grain-rich samples. However a number of other samples with low to moderate quantities of remains will be worthy of more detailed analysis due to their phasing and/or contextual relationships to the richer samples.

The final range of samples should be finalised alongside key research questions at an early stage of post-excavation, when the full breadth of the assemblage is known. It is anticipated that overall, perhaps 20 samples will be selected from the 2011–12 samples for their charcoal and 20 selected for their charred plant macrofossils. Temporal variation in charcoal types should provide detail regarding past fuel selection, from the well-preserved 6th Century SFB remains through to the roundwood in medieval grain-rich ash. The relatively few charred plant remains from the 6th, 7th and 12/13th centuries are an important contrast to the richer 8th–9th Century features examined by Campbell (2012), which appear to represent a distinctively intense and refuse-rich period of activity at Lyminge.

Whilst mineral-replaced invertebrates cannot support close taxonomic identifications, it is worth pursuing broad identifications (to Family, where possible) of the fly puparia to allow comparison of refuse types and refuse management across the different periods at Lyminge, and to the later Anglo-Saxon pit fills at Bishopstone. There are puparia recorded for 6 pit fills in the 2011–12 assemblage and 9 pit fills by Campbell (2012).

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BIBLIOGRAPHY

Ballantyne, R.M. 2009. 'Botanical evidence' in A. Dickens, S. Lucy and J. Tipper (eds.) The Anglo-Saxon Settlement and Cemetery at Bloodmoor Hill, Carlton Colville, Suffolk *East Anglian Archaeology Report* **131**, 305–316.

Ballantyne, R.M. 2010. 'Charred and mineralised biota', pp.164–76 in G. Thomas *The later Anglo-Saxon Settlement at Bishopstone: A Downland Manor in the Making*. (CBA Research Report 163). York: Council for British Archaeology.

Bell, B. and Dickson, C. 1989. Excavations at Warebeth (Stromness Cemetery) Broch, Orkney. *Proceedings of the Society of Antiquaries of Scotland* **119**, 101–131.

Campbell, G. 2012. Assessment of charred and mineral-replaced macroscopic plant remains from excavation at Lyminge, Kent, 2008–10. Unpublished specialist report for the Lyminge Archaeological Project.

Campbell, G. and Kenward, H. 2012. 'Insect and plant remains', in J. Tipper (ed.) Experimental archaeology and fire: the investigation of a burnt reconstruction at West Stow Anglo-Saxon village. *East Anglian Archaeology Report* **146**, 90–114.

Carruthers, W. 1989. Mystery object 2 – animal, mineral or vegetable? *Circaea* **6**(1), 20.

Greig, J.R.A. 1991. 'The British Isles', pp.299–334 in W. van Zeist, K. Wasylikowa and K. Behre (eds.) *Progress in Old World Palaeoethnobotany*. Rotterdam: Balkema.

Jones, M.K. 1988. 'The arable field: A botanical battleground', pp.86–92 in M.K. Jones (ed.) *Archaeology and the Flora of the British Isles*. Oxford: Oxford University Committee for Archaeology.

Marguerie,D. and Hunot, J.-Y. 2007. Charcoal analysis and dendrology: data from archaeological sites in north-western France. *Journal of Archaeological Science* **34**, 1417–1433.

McCobb, L.M.E., Briggs, D.E.G, Evershed, R.P. and Hall, A.R. 2001. Preservation of Fossil Seeds From a 10th Century AD Cess Pit at Coppergate, York. *Journal of Archaeological Science* **28**, 929–40.

McParland, L.C., Collinson, M.E., Scott, A.C., Campbell, G. & Veal, R. 2010. Is vitrification in charcoal a result of high temperature burning of wood? *Journal of Archaeological Science* **37**(10), 2679-2687.

Moffett, L. 1994. 'Charred cereals from some ovens/kilns in late Saxon Stafford and the botanical evidence for the pre-burh economy', pp.55–64 in J. Rackham (ed.) *Environment and economy in Anglo-Saxon England* (CBA Research Report 89). York: Council for British Archaeology.

Moffett, L. 2011. 'Food plants on archaeological sites. The nature of the archaeobotanical record', pp.346–360 in H. Hamerow, D.A. Hinton and S. Crawford (eds.) *The Oxford Handbook of Anglo-Saxon Archaeology*. Oxford: Oxford University Press.

Pelling, R. and Robinson, M. 2000. Saxon emmer wheat from the Upper and Middle Thames Valley, England. *Environmental Archaeology* **5**, 117–9.

Shillito, L.-M., Bull, I.D., Matthews, W. Almond, M.J., Williams, J. and Evershed, R.P. 2011. Biomolecular and micromorphological analysis of suspected faecal deposits at Neolithic Çatalhöyük, Turkey. *Journal of Archaeological Science* **38**, 1869–1877.

Stace, C. 1997. *New Flora of the British Isles* (second edition). Cambridge: Cambridge University Press.

Thomas, G. 2013. Life before the minster: the social dynamics of monastic foundation at Anglo-Saxon Lyminge, Kent. *Antiquaries Journal* **93,** 109–145.

Van der Veen, M., Hill, A. and Livarda, A. 2013. The archaeobotany of Medieval Britain (c AD 450–1500): identifying research priorities for the 21st century. *Medieval Archaeology* **57**, 151–182

Williams, D. 1973. Flotation at Sīraf. *Antiquity* **47**, 288–92.

Zohary, D. & Hopf, M. 2000. *Domestication of plants in the Old World* (third edition). Oxford: Oxford University Press.

Table 1: Assessment results for charred and mineral-replaced biota, Lyminge 2012 and 2013
Key: 1 present, 2 frequent, 3 common, 4 abundant, 5 superabundant (after Campbell 2012), p = present
hb = hulled barley, nw = naked wheat (a.k.a. free-threshing), hw = hulled wheat, glb = glume base

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
3091	LYM12	<18>	Pit fill	Anglo-Norman, 12/13th century	18		**2**	**2**	p		p	p							**1**			p	Free-threshing wheat and wheat grain, v few barley grain. 1 *Bromus* sp. seed. 1 charred fungal sclerotium. Uncharred *Sambucus* sp. seed.
3101	LYM12	<1>	Upper ditch fill	Medieval	21	<5	**2**	**1**	p										**1**	**1**			1 barley grain, cf. *Pisum sativum* cotyledons (no hilums). 1 *Trifolium* sp. seed.
3144	LYM12	<2>	Primary ditch fill	Medieval	7	<5	**1**																1 tiny fragment of parenchyma (likely from a legume cotyledon).
3188	LYM12	<16>	Pit fill	Anglo-Norman, 12/13th century	12		**3**	**2**	p	p	p	p								**1**			Free-threshing wheat and wheat grain, some barley grain incl. hulled, 1 rye/oat grain. 1 pea/bean cotyledon fragment.
3189	LYM12	<19>	Pit fill	Anglo-Norman, 12/13th century	12.5		**1**	**1**	p			p							**1**			p	Mostly free-threshing wheat grain and a few barley grain. 1 *Rumex* sp. seed, 1 *Brassica/Sinapis* and 1 medium-sized wild grass seed. Uncharred *Sambucus* sp. seed.
3195	LYM12	<13>	Pit fill	Anglo-Saxon phase 2 (7th century)	6.5		**2**	**1**	p												p		1 barley grain, 1 rye/oat grain. Mineral-replaced earthworm cocoons. Incl. vitrified charcoal.
3205	LYM12	<107>	Post hole fill	Anglo-Saxon phase 2 (7th century)		>50	**1**	**1**															Barley grain fragment.
3207	LYM12	<100>	Pit fill	Anglo-Saxon phase 2 (7th century)	6.5		**3**	**1**			p										p		1 wheat grain. Lots of mineral-replaced earthworm coccoons.
3208	LYM12	<20>	Pit fill	Anglo-Norman, 12/13th century	13		**1**	**3**	p		p	p			p			p	**1**		p		Mostly free-threshing wheat grain, with barley, wheat, rye and indet. grain. 1 cereal culm node. 1 small *Vicia/Lathyrus* sp. seed. Two flots very different quantities of grain. Mineral-replaced millipede exoskelton fragments and 1 earthworm coccoon.
3240	LYM12	<21>	Pit fill	Anglo-Norman, 12/13th century	6.5	100	**1**	**1**														p	Grain indet. fragment. Uncharred *Sambucus* sp. seed. Amphibian bone.
3242	LYM12	<17>	Pit fill	Anglo-Norman, 12/13th century	10.5		**2**	**2**	p		p	p									p		Mostly free-threshing wheat grain and wheat grain, some barley and indet. grain. Small vertebrate bone. Mineral-replaced ?fungal sclerotium.
3245	LYM12	<6>	Post hole fill	Anglo-Norman, 12/13th century	4	25-50	**1**	**2**	p	p	p			p					**1**				Mostly barley grain, some hulled. Also 1 wheat grain, oat seed fragment. 1 *Atriplex* sp. seed and 1 *Trifolium* sp. seed.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
3248	LYM12	<4>	Ditch fill	Medieval	9.5		2	3			p	p			p				1	1		p	Free-threshing wheat grain, wheat grain, grain indet. - preservation is fair. 1 rye grain and 1 cf. *Pisum sativum* cotyledon (no hilum). 1 *Lolium* cf. *temulentum* seed. 2 uncharred *Sambucus* sp. seed fragments. Incl. vitrified charcoal.
3253	LYM12	<79>	Post hole fill	Timber Hall, Anglo-Saxon Phase 2 (7th century) - v. likely	3		1															p	Uncharred *Sambucus* sp. seed.
3265	LYM12	<36>	Pit fill	Anglo-Norman, 12/13th century	14		2	2	p		p	p							1				Barley grain, free-threshing wheat grain, wheat grain. Medium *Vicia/Lathyrus* sp. seed.
3288	LYM12	<12>	Pit fill	Anglo-Saxon phase 2 (7th century)	1	100	1	1															1 grain indet. Likely *Quercus* charcoal fragment.
3296	LYM12	<14>	Pit fill	Anglo-Saxon phase 2 (7th century)	7		1	2		p		p		p					1				Hulled barley grains, 1 free-threshing wheat grain, 1 oat seed. 1 small Brassicaceae indet. seed.
3302	LYM12	<15>	Pit fill	Anglo-Saxon phase 2 (7th century)	5		1	2				p		p						1			Free-threshing wheat grain, oat seed, Vicia faba var. minor seed.
3398	LYM12	<31>	Pit fill	Anglo-Norman, 12/13th century	12		2	1				p								1	p		1 free-threshing wheat grain. 1 *Vicia faba* var. *minor*. 2 mineral-replaced *Brassica/Sinapis* sp. seeds and millipede exoskelton fragments. 1 fly puparium. Two flots quite different in grain.
3427	LYM12	<95>	Pit fill	Timber Hall, Anglo-Saxon Phase 2 (7th century) - v. likely	6.5		3	1	p		p												2 barley grain, 1 wheat grain (possibly hulled).
3463	LYM12	<64>	Pit fill	Anglo-Norman, 12/13th century	12		3	2	p		p	p							1		p	p	Mostly wheat grain, incl. free-threshing wheat grain, also barley grain and grain indet. 1 *Rumex* sp. seed. 5 mineral-replaced *Brassica/Sinapis* sp. seeds and one ?seed. Uncharred *Sambucus* sp. seed.
3483	LYM12	<27>	Fill of truncated ditch	Anglo-Norman, 12/13th century (most likely)	6.5		2	1	p		p											p	Several barley grain, 1 wheat grain. Uncharred *Sambucus* sp. seed fragment.
3484	LYM12	<65>	Cess pit fill	Anglo-Norman, 12/13th century	18		2	2	p			p	p								p		Free-threshing wheat grain, hulled wheat grain (dorsal ridge and elongate), barley grain. Mineral-replaced *Rumex* sp. seed, *Bromus* cf. *secalinus* seed. Mineral-replaced puparia (incl. 1 likely Calliphoridae). Amorphous calcium phosphate fragments. Small vertebrate bones.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
3525	LYM12	<37>	Pit fill	Anglo-Norman, 12/13th century	15		**2**	**3**	p	p	p	p					p		**1**	**1**		p	**Flot from bags 1 & 2 of 4 not posted to Cambridge - so only flot from bags 3 & 4 analysed.** Mostly free-threshing wheat grain, plus barley grain incl. hulled. 1 free-threshing wheat rachis internode. 1 ?*Pisum sativum* cotyledon (no hilum). ?*Aethusa cynapium* endosperm and 1 *Phleum* sp. seed. Uncharred *Sambucus* sp. seed.
3527	LYM12	<124>	Secondary pit fill	Anglo-Norman, 12/13th century	6		**4**	**3**	p		p	p							**1**				Mostly free-threshing wheat grain. Also some barley and wheat grain. 1 small *Vicia/Lathyrus* sp. seed. A few small vertebrate bones.
3534	LYM12	<34>	Cess deposit	Anglo-Norman, 12/13th century	8		**1**	**1**	p			p							**1**	**1**	p		Barley grain and free-threshing wheat grain. 1 *Vicia faba* var. *minor*. *Galium aparine* seed. Small bone fragments incl. amphibian. Quite a bit of millipede exoskeleton that looks mineral-replaced.
3535	LYM12	<38>	Pit fill	Anglo-Norman, 12/13th century	12.5		**3**	**4**	p	p	p	p		p					**1**				60% barley grain, some hulled and twisted, 40% free-threshing wheat grain (incl. 1 tail grain), wheat grain and oats. Preservation occasionally excellent. 2 *Rumex* sp., 1 *Phleum* sp. and 1 *Bromus* cf. *secalinus* seed.
3539	LYM12	<40>	Pit fill	Anglo-Norman, 12/13th century	14.5	5-25	**3**	**4**	p	p	p	p		p					**1**	**1**	p	p	60% barley grain incl. hulled, 40% free-threshing wheat grain and few oats. Rather silty and grain preservation fair. 1 cf. *Pisum sativum* (no hilum) and 1 *Rumex* sp. seed. Mineral-replaced *Brassica/Sinapis* sp. seeds, grass culm fragments, millepede exoskeleton fragments, earthworm coccoon and woodlouse segment. Small vertebrate bones incl. amphibian. Uncharred *Sambucus* sp. seed.
3560	LYM12	<89>	Wall trench fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	3.5		**4**	**2**	p	p				p						**1**	p		Mostly hulled barley and barley grain. 1 oat seed. 1 cf. *Vicia faba* var. *minor* fragment. Mineral-replaced earthworm coccoon and ?fungal body. Uncharred *Sambucus* sp. seeds. Incl. vitrified charcoal blobs.
3597	LYM12	<41>	Pit fill	Anglo-Saxon phase 2 (7th century)	13		**2**	**1**		p												p	1 hulled barley grain. Uncharred *Sambucus* sp. seed.
3637	LYM12	<66>	Tertiary pit fill	Anglo-Norman, 12/13th century	13		**1**	**2**			p	p									p		Free-threshing wheat and wheat grain. Amorphous calcium carbonate fragments. Small vertebrate bone.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
3639	LYM12	<47>	Cess fill	Anglo-Norman, 12/13th century	12		**1**	**2**	p			p	p							**1**	p		Barley grain, free-threshing wheat grain. 1 hulled wheat grain (dorsal ridge and elongate). 1 likely *Vicia faba* var. *minor* cotyledon fragment. Small vertebrate bone. Amorphous calcium phosphate concretions.
3641	LYM12	<42>	Pit fill	Anglo-Norman, 12/13th century	12.5	5-25	**3**	**4**	p	p	p	p		p			p		**1**		p	p	80% free-threshing wheat grain, 15% barley (occ. hulled) and 5% oats. 1 free-threshing wheat rachis internode. 1 medium-sized wild grass seed, *Chenopodium* sp. seed and seed indet. A few charcoal fragments >1cm. 2 mineral-replaced fly puparia. Small vertebrate bones and fishscale.
3665	LYM12	<43>	Pit fill	Anglo-Norman, 12/13th century	13.5	5-25	**2**	**3**	p	p	p	p		p			p				p		Mostly free-threshing wheat grain, also barley grain occ. hulled, oats. 1 free-threshing wheat rachis internode. Mineral-replaced grass culm fragments and earthworm coccoons. Amphibian bone.
3667	LYM12	<67>	Secondary pit fill	Anglo-Norman, 12/13th century	12		**1**	**1**				p							**1**				2 free-threshing wheat grain, 1 wheat grain. 1 *Anthemis cotula* seed.
3673	LYM12	<45>	Pit fill	Anglo-Norman, 12/13th century	13.5		**1**	**1**		p		p									p		Hulled barley and free-threshing wheat grain. Mineral-replaced *Malus/Pyrus* sp. seed, ?*Agrostemma githago* , *Atriplex* sp. seed, plus grass culm fragments. Also mineral-replaced millipede exoskeleton, incl. flat type, and fly puparia. Amorphous calcium phosphate concretions. Plenty of small vertebrates.
3697	LYM12	<103>	Pit fill	Anglo-Norman, 12/13th century	5.5		**2**	**2**			p	p									p		1 mineral-replaced *Malus/Pyrus* sp. seed. Free-threshing wheat grain and wheat grain. Mineral-replaced millipede exoskeleton.
3704	LYM12	<30>	SFB5, Spit 3, NE Quad	SFB5, Anglo-Saxon Phase 1 (6th century)	4		**3**	**2**	p					p						**1**			Barley grain, grain indet., oat seed. ?Pea/bean cotyledon fragment?
3705	LYM12	<32>	SFB5, Spit 4, NE Quad	SFB5, Anglo-Saxon Phase 1 (6th century)	10		**4**	**2**	p	p											p	p	Barley and hulled barley grain (incl. 1 hulled and twisted). Mineral-replaced earthworm cocoon and ?fungal body. Uncharred *Sambucus* sp. seed.
3705	LYM12	<35>	SFB5, Spit 4, NE Quad	SFB5, Anglo-Saxon Phase 1 (6th century)	6		**3**	**1**	p	p													Hulled barley and barley grain.
3707	LYM12	<44>	SFB 5, Spit 6, NE Quad	SFB5, Anglo-Saxon Phase 1 (6th century)	7.5		**4**	**2**	p	p											p		Mostly hulled barley grain. 2 mineral-replaced ?fungal bodies.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6093	LYM13	<78>	Post hole fill	Unphased: double post hole sequence N of buildings	10		**2**	**1**	p	p									**1**				1 barley and 1 hulled barley grain. 1 *Trifolium* seed. Some insect-damaged charcoal.
6105	LYM13	<79>	Post hole fill	Unphased: double post hole sequence N of buildings	10		**2**												**1**			p	1 small *Vicia/Lathyrus* . Recent uncharred *Chenopodium album* . Tarry globules. + uncharred fly puparia.
6107	LYM13	<80>	Post hole fill	Unphased: double post hole sequence N of buildings	10		**1**	**1**	p					p					**1**				1 oat, 1 barley, 1 grain indet. fragment. 1 *Trifolium* sp. seed.
6119	LYM13	<54>	SW Quad of slag fill	Anglo-Saxon Phase 2 (7th century)	10	<5	**2**	**2**	p			p											Free-threshing wheat and barley grain - heavily charred. Some vitrified charcoal.
6119	LYM13	<55>	NW Quad of slag fill	Anglo-Saxon Phase 2 (7th century)	10	<5	**2**	**1**			p		p									p	3 wheat grain; 1 appears hulled. 1 browned subrounded wood fragment. Incl. roundwood, some insect damaged.
6119	LYM13	<58>	SE Quad periphery of slag fill	Anglo-Saxon phase 2 (7th century)	20		**2**	**2**	p		p	p											Barley and free-threshing wheat grain. Poorly preserved.
6201	LYM13	<1>	SFB 7 Spit 1, exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**1**												**1**				Incl vitrified charcoal and tarry globules. 1 parenchyma fragment - looks like a legume cotyledon. Insect attacked charcoal frag.
6201	LYM13	<2>	SFB 7 Spit 1, Interior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**1**	**1**			p	p											Incl. tarry globules.
6202	LYM13	<15>	SFB 7 Spit 2, Interior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**										p					p	1 free-threshing *Triticum* rachis internode. 1 uncharred *Sambucus* seed. A few tarry globules and vitrified charcoal fragments. A few charred fungal sclerotia (*Cenococcum*).
6202	LYM13	<16>	SFB 7 Spit 2, Exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**2**	**1**		p				p					**1**			p	Hulled barley grain and 1 oat seed fragment. A few tarry globules. 1 *Rumex* and 1 *Trifolium* seed. 1 uncharred *Sambucus* seed.
6204	LYM13	<37>	SFB 7, Spit 3, NE Quad, Interior	SFB7, Anglo-Saxon Phase 1 (6th century)	10		**4**														p		Several mineral-replaced ?fungal bodies
6204	LYM13	<38>	SFB 7, Spit 3, NE Quad, Exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10		**4**	**1**	p	p		p		p							p		Hulled barley, free-threshing wheat, oat. + mineral-replaced seed/fungi and millipede fragment. 1 charred fungal sclerotia.
6207	LYM13	<48>	SFB 7, Spit 4, NW Quad, Interior	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**												**1**				2 *Chenopodium* sp. endosperm.
6226	LYM13	<3>	SFB 7 Spit 1, exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**1**	**1**			p								**1**			p	Incl. tarry globules. Uncharred *Sambucus* seed. Charred *Chenopodium* cf. *polyspermum* seed
6226	LYM13	<4>	SFB 7 Spit 1, Interior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**2**	**1**	p			p							**1**				Incl. tarry globules, vitrified and charred concreted fragments. 1 *Anthemis cotula* seed.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6229	LYM13	<17>	SFB 7 Spit 2, Interior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**																
6229	LYM13	<18>	SFB 7 Spit 2, Exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**1**		p		p											Free-threshing wheat grain and hulled barley.
6230	LYM13	<19>	SFB 7 Spit 2	SFB7, Anglo-Saxon Phase 1 (6th century)	10	<5	**2**	**1**	p	p									**1**				Barley and hulled barley grain, 1 small ?*Lolium* seed and 1 *Anthemis cotula* seed.
6233	LYM13	<29>	SFB 7 Spit 3, Interior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	10		**4**																1 fish vertebra and a bone fragment. Incl. vitrified charcoal.
6233	LYM13	<30>	SFB 7 Spit 3, Exterior sample	SFB7, Anglo-Saxon Phase 1 (6th century)	5	<5	**3**															p	Uncharred *Prunus* stone fragment.
6236	LYM13	<35>	SFB 7, Spit 3, Central area. Possible cut.	SFB7, Anglo-Saxon Phase 1 (6th century)	20	<5	**4**	**1**	p		p	p											Free-threshing wheat grain and 1 barley. 1 *Rumex* seed.
6253	LYM13	<175>	Pit fill	Anglo-Saxon Phase 2 (7th century)	10		**1**	**1**				p							**1**				Free-threshing wheat grain. *Lolium* cf. *temulentum* seed. Incl. tarry vitrified globules. Fine flot refloated as very silty.
6304	LYM13	<13>	Pit fill	Anglo-Norman or Medieval ('Medieval tile' in fill)	11	50	**2**															p	Much vitrified charcoal, with some concreted fragments and tarry globules. Many uncharred *Rubus idaeus* seeds, some uncharred *Sambucus* seed. Charred fungal sclerotia.
6306	LYM13	<22>	Ditch fill	Medieval	20		**3**	**2**	p		p	p					p		**1**				Barley, wheat and free-threshing wheat grain - poorly preserved. 1 free-threshing *Triticum* rachis internode. 1 *Galium aparine* seed.
6316	LYM13	<14>	Pit fill	Anglo-Norman or Medieval ('Medieval tile' in fill)	9	50	**2**															p	Much vitrified and concreted charcoal, with tarry globules. Fly ash. + uncharred *Rubus idaeus* seeds, * *Sambucus* seeds and subrounded wood fragments. Some silica fly ash.
6333	LYM13	<92>	Post hole fill	Anglo-Saxon Phase 2 (7th century)	10		**2**	**1**											**1**	**1**		p	1 grain indet. fragment, 1 large legume cotyledon fragment. 1 *Poa* sp. seed. 1 uncharred *Urtica dioica* seed.
6351	LYM13	<158>	Fence post	Anglo-Saxon Phase 2 (7th century)			**1**																
6373	LYM13	<159>	Fence post	Anglo-Saxon Phase 2 (7th century) - likely	4		**1**	**1**		p													1 hulled barley grain fragment.
6383	LYM13	<170>	Pit fill	Anglo-Norman, 12/13th century	40		**2**	**2**	p		p	p											Mostly barley grain, some wheat grain - one clearly free-threshing.
6385	LYM13	<168>	Pit fill	Anglo-Norman, 12/13th century	20		**2**	**1**	p	p		p											Hulled barley, barley and free-threshing wheat grain. Incl. a fragment of vitrified charcoal.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6387	LYM13	<167>	Pit fill	Anglo-Norman, 12/13th century	30		**1**	**2**	p	p		p		p						**1**	p		Hulled barley grain and barley grain fragments. Free-threshing wheat grain. 1 *Vicia faba* var. *minor*, 1 cf. *Pisum sativum* cotyledon (no hilum). Coarse flot refloated as very silty. Mineral-replaced *Brassica/Sinapis* seed. 1 amphibian bone.
6401	LYM13	<95>	Pit fill	Anglo-Norman, 12/13th century	25		**2**	**1**	p			p					p		**1**	**1**			2 barley grain, 1 free-threshing wheat grain, several grain indet. 1 *Vicia faba* var. *minor* seed. 2 free-threshing wheat rachis internodes. 1 *Polygonum aviculare* seed. 1 small seed indet. fragment.
6429	LYM13	<11>	Upper ditch fill	Anglo-Norman, 12/13th century	11		**2**	**2**	p			p							**1**				Grain very pitted and abraded. Small legume (*Vicia/Lathyrus*). Includes *Quercus* and roundwood charcoal. A few charred fungal sclerotia (*Cenococcum*).
6449	LYM13	<116>	Post hole fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**1**																
6499	LYM13	<12>	Upper pit fill	Anglo-Norman, 12/13th century	20		**2**	**2**	p	p	p	p		p			p						1 hexaploid *Triticum* rachis internode.
6520	LYM13	<49>	Post hole, hall façade.	Timber Hall, Anglo-Saxon Phase 2 (7th century)	15	50	**1**	**1**			p												1 wheat grain. Rodent bones.
6524	LYM13	<145>	Post hole fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**3**	**1**				p								**1**			1 free-threshing wheat grain. 1 *Vicia faba* var. *minor*. Grey siliceous fly ash fragments and 2 iron smithing spheroids.
6578	LYM13	<26>	Medieval pit	Medieval	10	50	**1**	**1**						p					**1**				1 oat seed fragment, 1 *Ranunculus acris/bulbosus/repens* seed. Vitrified charcoal. A few silica fly ash fragments.
6594	LYM13	<20>	Medieval ditch fill	Medieval	20		**3**	**5**	p	p	p	p					p		**1**	**3**			c.60% free-threshing wheat grain and 40% hulled barley (incl. a few twisted grains). Presv generally poor - puffed and pitted. 2 barley rachis internodes (1 6-rowed). ?50 free-threshing wheat rachis internodes. *Vicia faba* var. *minor* and *Pisum sativum*. 1 *Brassica/Sinapis* sp. seed, 1+ *Lolium* cf. *temulentum, 2 Silene* sp. seeds. Fine flot refloated as v silty and concreted. Incl. some twiggy roundwood. Occasional charred fungal sclerotia.
6633	LYM13	<121>	Post hole fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**1**																Grey siliceous fly ash fragment. 1 iron smithing spheroid.
6661	LYM13	<23>	Ditch fill	Medieval	10		**1**	**1**						p								p	1 *Avena* seed. Uncharred *Taraxacum* seed (likely recent in origin).
6701	LYM13	<77>	Potential Bronze Age post hole	Prehistoric?	10	100	**1**																

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6706	LYM13	<108>	Post hole fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	20		**2**	**2**			p	p								**1**			Several free-threshing wheat grain, with some wheat and unidentifiable grain. 1 pea/bean cotyledon fragment.
6739	LYM13	<169>	Pit fill	Anglo-Norman, 12/13th century	10		**1**	**2**	p			p											Barley grain, free-threshing wheat grain, grain indet. Fine flot refloated as very silty.
6745	LYM13	<24>	Charcoal rich ditch fill	Medieval	16		**4**	**5**	p	p	p	p		p	p		p	p	**1**	**2**		p	c.50% free-threshing wheat grain and 50% hulled barley (incl. a few twisted grains). Occasional rye and oats. Presv fair - moderate puffing and pitting of grain. *Pisum sativum* , from few with preserved hilum. 3+ *Lolium temulentum* seeds, 2 *Brassica/Sinapis* sp. and 1 *Anthemis cotula* seed. Tetraploid wheat rachis internodes (2 articulated) and free-threshing wheat rachis internodes. Cereal culm base (with roots). *Hordeum vulgare* rachis internode (fragment). Incl. some large charcoal fragments (>1cm).
6763	LYM13	<25>	Charcoal rich pit fill	Anglo-Saxon phase 2 (7th century): B4 raking post	4	50	**3**																1 spheroid from iron smithing
6764	LYM13	<27>	Medieval ditch	Medieval	20		**3**	**5**	p	p	p	p		p					**2**	**1**			c.50% free-threshing wheat grain and 50% hulled barley (incl. a few twisted grains). V few oats. Presv fair - moderate puffing and pitting of grain. Probably peas and beans from gross morphology. *Rumex* sp., small *Vicia/Lathyrus* , 1 ?*Raphanus raphanistrum* capsule fragment, 1 ?*Avena* chaff, 1 charred *Cenococcum* sclerotia. Lots of fine fragments that appear to be ?grass culms. Charcoal includes roundwood and some insect damage.
6766	LYM13	<28>	Pit	Anglo-Saxon Phase 2 (7th century)	10		**2**												**1**				Some insect damaged charcoal. Silica fly ash. 1 *Aira* sp. seed. Fish scale fragment.
6801	LYM13	<39>	SFB 6 , Spit 1, Exterior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**												**1**		p		1 *Anthemis cotula.* A mineral-replaced seed/?fungal body.
6803	LYM13	<34>	Fill of wall trench cutting SFB6	Timber Hall, Anglo-Saxon Phase 2 (7th century)	20	<5	**2**																
6805	LYM13	<45>	SFB 6, Spit 2, Interior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**2**	p			p		p					**1**			p	Mostly barley grain, some hulled, also free-threshing wheat (1 germinated) and oats. 1 *Trifolium/Medicago* seed. 1 fragment of uncharred *Sambucus* seed.
6806	LYM13	<46>	SFB 6, Spit 2, Exterior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**1**	p			p											A few barley and free-threshing wheat grains.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6809	LYM13	<63>	SFB 6, Spit 3, NW Quad	SFB6, Anglo-Saxon Phase 1 (6th century)	10		**3**	**1**	p			p							**1**				Hulled barley and free-threshing wheat grain. Some insect damaged charcoal. Seeds of 1 *Rumex acetosella* , 1 ?*Poa* , 1 *Chenpodium album* .
6811	LYM13	<62>	SFB 6, Spit 3, NW Quad	SFB6, Anglo-Saxon Phase 1 (6th century)	10		**2**	**1**	p		p	p										p	A few barley and wheat grain, one free-threshing. 1 uncharred *Sambucus* seed.
6812	LYM13	<61>	SFB 6, Spit 3, NW Quad	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**2**	**1**	p	p													A few barley grain, one clearly hulled.
6814	LYM13	<69>	Wall trench cutting SFB 6, Spit 4, NW Quad	Timber Hall, Anglo-Saxon Phase 2 (7th century)			**2**	**1**			p								**1**	**1**			1 wheat grain. Charred frags. of concreted ?chaff/seeds. 2 pea/bean cotyledon fragments. 1 *Poa* seed. Some insect damaged charcoal.
6815	LYM13	<67>	SFB 6, Spit 4, NW Quad fill	SFB6, Anglo-Saxon Phase 1 (6th century)	10		**3**	**2**	p		p	p											Mostly barley with some free-threshing wheat grain - preservation fair.
6826	LYM13	<31>	SFB 6 Spit 1, Interior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**												**1**				1 *Atriplex* sp. seed.
6826	LYM13	<32>	SFB 6, Spit 1, Exterior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**1**	p														A few barley grain - poorly preserved.
6830	LYM13	<44>	SFB 6, Spit 2, Interior sample - Wall trench fill / redeposited SFB fill	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**2**	p	p				p									Mostly barley, 1 oat seed. Incl. insect damaged charcoal.
6834	LYM13	<43>	SFB 6, Spit 2, Interior sample - Wall trench fill / redeposited SFB fill	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**3**	**4**	p	p	p	p	p	p									70% hulled barley, with some grains also twisted. 30% wheat; mostly free-threshing, but 1 or 2 look hulled. 1 or 2 oat seeds. Preservation good to excellent.
6835	LYM13	<42>	SFB 6, Spit 2, Exterior sample	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**1**	**1**												**1**			1 grain indet., 1 legume indet.
6842	LYM13	<57>	Wall trench cutting SFB 6, with redeposited SFB fill.	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**2**	**1**	p		p	p	p								p		Barley grain - 1 germinated - also wheat grain of which 1 clearly hulled and 1 free-threshing. Incl. mineral-replaced ?fungal bodies. Incl. vitrified charcoal.
6842	LYM13	<186>	SFB 6	SFB6, Anglo-Saxon Phase 1 (6th century)	10	<5	**1**	**1**	p														1 barley grain. Incl. vitrified charcoal fragment.
6877	LYM13	<162>	Wall trench fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**2**	**2**	p	p		p			p								1 rye grain fragment plus hulled barley and barley grain fragments. 1 free-threshing wheat grain. Incl. likely *Quercus* charcoal fragment(s). Grey/yellowish-grey siliceous ash fragments (?slag). Iron smithing spheroid. Fine flot refloated as very silty.

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
6919	LYM13	<166>	Pit fill	Anglo-Norman, 12/13th century	40		**1**	**2**	p		p	p								**2**			Barley and free-threshing wheat grain. Also indet. grain and possibly hulled wheat - but preservation very poor (pitting and fragmentation). 1 *Vicia faba* var. *minor* and several cf. *Pisum sativum* cotyledons (no hilums).
6928	LYM13	<118>	Door post	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**1**	**1**															1 grain indet. fragment
6931	LYM13	<60>	Post pit fill	Anglo-Saxon phase 2 (7th century)	10		**1**	**1**															1 grain indet. fragment
6937	LYM13	<51>	Base of hall post setting	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10	100	**2**	**1**	p				p										1 fragment of a hulled wheat grain. 1 barley grain. Amphibian bones. Burnt bone.
6965	LYM13	<64>	SW Quad of slag fill	Anglo-Saxon Phase 2 (7th century)	20		**2**	**1**			p	p							**1**	**1**			Free-threshing wheat grain. 1 pea/bean. Some vitrified charcoal. 1 *Trifolium* sp. seed.
6987	LYM13	<97>	Wall trench cutting SFB 6	Timber Hall, Anglo-Saxon Phase 2 (7th century)	20		**3**	**2**	p	p	p			p					**1**				2 hulled, twisted barley grain. Also hulled barley, 1 wheat grain and some oat seeds. 1 *Poa* sp. seed.
7012	LYM13	<124>	Possible 3rd SFB fill	SFB6, Anglo-Saxon Phase 1 (6th century)	2		**2**	**1**	p	p									**1**				1 hulled barley grain and 1 barley grain. 1 *Lapsana communis* seed.
7014	LYM13	<82>	Post hole associated with slag-filled pit	Anglo-Saxon Phase 2 (7th century)	20		**2**	**2**		p	p	p											Mostly free-threshing wheat grain. Also some wheat and indeterminate grain. 1 hulled barley. Incl. *Quercus* and vitrified charcoal. Fine flot refloated as very silty.
7016	LYM13	<83>	Post hole associated with slag-filled pit	Anglo-Saxon Phase 2 (7th century)	5	50	**1**	**1**				p		p									2 free-threshing wheat grain, 1 oat seed. Incl. vitrified charcoal.
7027	LYM13	<119>	Door post	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**2**																1 iron smithing spheroid
7030	LYM13	<107>	Plank ghost	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**1**	**1**			p	p							**1**			p	Free-threshing wheat grain, also wheat grain and indet. grain. 1 *Mentha* sp. seed. Uncharred *Taraxacum* sp. seed (?recent).
7038	LYM13	<120>	Door post	Timber Hall, Anglo-Saxon Phase 2 (7th century)	10		**1**												**1**			p	1 P*hleum* sp. seed. Uncharred *Sambucus* sp. seed.
7074	LYM13	<114>	Door post fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	20		**3**	**1**	p										**1**				1 barley grain fragment and 1 grain indet fragment. 1 Chenopodiaceae endosperm, 1 small ?Poaceae , 1 ?Fabaceae and 1 ?Polygonaceae indet.
7134	LYM13	<129>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	3		**1**	**1**	p														1 barley grain and 1 grain indet. fragment.
7136	LYM13	<128>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	3		**1**	**1**		p									**1**				1 hulled barley grain and 1 grain indet. 1 vitrified charcoal fragment. 1 Chenopodiaceae indet. endosperm.
7138	LYM13	<133>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	3.5		**1**															p	1 uncharred *Taraxacum* sp. seed (?recent).

Context	Site code	Sample number	Context description	Association	Sample vol (L)	% context (if known)	Charcoal	Grain	Barley	hb	Wheat	nw	hw	Oat	Rye	glb	rachis	culm node	Seeds	Large legumes	Mineral-replaced	Un-charred	Notes (charred unless otherwise stated)
7140	LYM13	<135>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	2		**1**																
7144	LYM13	<137>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	8		**2**	**1**		p		p											1 hulled barley grain and 1 free-threshing wheat grain.
7146	LYM13	<134>	Plank slot	Timber Hall, Anglo-Saxon Phase 2 (7th century)	1		**1**																
7151	LYM13	<126>	Burnt material in wall trench	Timber Hall, Anglo-Saxon Phase 2 (7th century)	1		**2**																1 iron smithing spheroid.
7156	LYM13	<130>	Lower fill of slag-filled pit - C7th cess fill.	Timber Hall, Anglo-Saxon Phase 2 (7th century)	40		**1**	**1**	p												p		1 charred barley grain and 1 grain indet. Mineral replaced: ++ fish vertebrae (incl. eel), small ?mammal bones, tiny fragments of large mammal bones, amorphous calcium phosphate concretion fragments (from ?dog faeces) with occasional embedded mineral-replaced grass culm fragments. 2 mineral-replaced millipede exoskeleton fragments, 1 fly puparium, 1 earthworm cocoon and 1 ?fungal body.
7164	LYM13	<127>	Upper fill of cess pit	Timber Hall, Anglo-Saxon Phase 2 (7th century)	20		**4**	**1**				p								**1**			1 free-threshing wheat grain, 1 cf. *Pisum sativum* cotyledon. + iron smithing spheroids. Iron slag fragment.
7166	LYM13	<144>	Corner post hole in wall trench	Timber Hall, Anglo-Saxon Phase 2 (7th century)	2		**2**																1 fragment of charred concretion.
7209	LYM13	<152>	Wall trench fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	40		**3**	**2**	p	p		p		p					**1**			p	Mostly poorly preserved barley or hulled barley grain, incl. 1 germinated grain and 1 naked barley grain. A few free-threshing wheat grain and oats. 1 small Brassicaceae indet. seed. Uncharred *Sambucus* sp. seed.
7288	LYM13	<176>	Cess fill	Timber Hall, Anglo-Saxon Phase 2 (7th century)	40		**3**	**2**	p			p		p							p		Equal proportions of barley grain and free-threshing wheat grain, 2 oat seeds. 1 charred fungal theca. 1 mineral-replaced *Brassica/Sinapis* sp. seed. Fish scale, fish vertebra and mineral-replaced arthropod exoskelton fragments. Amphibian bone and other small mammal bone. Amorphous calcium phosphate concretions.

A SUMMARY OF THE NATURE OF THE SAXO-NORMAN ANIMAL REMAINS FROM LYMINGE

Matilda Holmes

INTRODUCTION

A moderate assemblage of *c* 5,000 animal bones and teeth from Saxo-Norman features was scanned and catalogued. Bones were in fair condition but highly fragmentary and 944 could be identified to taxa. This is a summary report of the major findings.

METHODOLOGY

Due to various constraints, a modified recording strategy was implemented to assess the nature of the zooarchaeology of Saxo-Norman Lyminge. Each context was scanned, and those with bones and teeth that could be identified to taxon and/ or anatomical element were recorded. A basic method was undertaken. Where possible the element, taxon and state of fusion was recorded for each bone fragment, and each mandibular deciduous fourth premolar or molar was recorded to taxon. Teeth were also given a wear stage following guidelines from Payne (1973) and Grant (1982). Articulated or associated fragments were entered as a count of one, so they did not bias the relative frequency of species present. All other animal remains were recorded as unidentified.

Due to anatomical similarities between sheep and goat, bones of this type were assigned to the category 'sheep/ goat', unless a definite identification (Zeder and Lapham 2010; Zeder and Pilaar 2010) could be made. Horses, donkeys and mules were separated based on tooth morphology (Eisenmann 1986; Johnstone 2006), and dogs and foxes using bone morphology and metapodial measurements (Ratjen and Heinrich 1978). Vertebrae were recorded when the vertebral body was present, and the zygomatic arch and occipital areas of the skull were identified from skull fragments.

Quantification of taxa and anatomical elements used a count of all fragments, NISP (number of identified specimens). Mortality profiles were constructed based on tooth eruption and wear of mandibles (Grant 1982; Jones and Sadler 2012) and bone fusion (O'Connor 2003). Cattle and sheep/ goats were sexed on the basis of pelvis morphology (Davis 2000; Greenfield 2006), and pigs by their canines (Schmid 1972).

TAPHONOMY

Bones were in fair condition but highly fragmentary. Although not quantified, it was noted that a considerable proportion of the assemblage showed signs of canid gnawing, indicating that bones were not buried immediately following discard but were available for dogs to chew. Just over half the teeth recorded were loose, which can also suggest a delay in burial, or post-depositional disturbance, as it takes several months for the tough connective tissue holding teeth in the mandible to break down and cause them to become loose.

There were no obvious deposits of primary butchery, skin-processing or craft-working waste, although a fragment of worked bone was recovered from context 6776, this was bagged separately in Box 7. While butchery marks were not recorded, evidence for skinning came from cattle phalanges with cut marks, and the removal of sheep and goat horn cores from the skull is indicative of either horn working or skinning (Serjeantson 1989). A few primary contexts are implied by the presence of associated bones that were subject to limited disturbance since deposition. These include loose epiphyses recovered alongside their corresponding metaphyses from contexts 3598, 3398 and 3639, and several associated bone groups:

- Context 3033 — two juvenile cat femurs (left and right side)
- Context 3484 — adult domestic fowl partial skeleton (coracoid, humerus, radius, tibia)
- Context 3590 — adult cat tibiae and femurs (left and right sides)
- Context 3625 — a juvenile sheep partial skeleton (scapula, metacarpal and pelvis)
- Context 3631 — a perinatal sheep/ goat humerus and radius and the ulna and femur of an adult goose
- Context 3640 — a perinatal lamb skeleton, including vertebrae, fore and hind limbs
- Context 6603 — subadult cattle ribs and several cervical and thoracic vertebrae
- Context 6776 — the metatarsal and associated lateral metapodials of an adult horse

THE ASSEMBLAGE

The assemblage was dominated by the remains of the major domesticates (cattle, sheep/ goat and pig), which most likely originated as food waste (Table 1). Other taxa contributing to the diet include red deer, domestic fowl (most likely chicken and including a bantam-sized bird), duck, goose, possibly the gull, and fish that included gadidae (cod family), of which a haddock-sized dentary was identified. Other animals were also present, some of which would have had working relationships with those living at the site, such as the equids (horse or donkey), canids (dog or fox) and cats; some would have been found in the surrounding area such as the passerine (small garden-bird size) and frog/ toad remains. The latter were numerous, testament to a good recovery programme, and indicate that there was a water source close by.

Sheep/ goat and cattle remains were recovered in similar quantities (Table 1), although the larger carcass size of cattle would have provided considerably more beef than lamb. The relatively high proportion of pig remains, identified as over 20 per cent of the major domesticates, is typical of a high-status diet (Holmes 2018, 71). The diversity of food taxa also implies that those living at the site had the ability to procure food from a wide range of sources. The presence of red deer metapodials is typical of elite sites (Sykes 2007), and reflects the consumption of venison, which is also associated with a high-status diet.

The bones of cattle, sheep/ goat and pigs came from all parts of the carcass (Table 2), but there was a bias towards the main meat-bearing limb bones (scapula, humerus, radius and ulna and pelvis, femur and tibia), which suggests that while whole carcasses were processed in the area, additional joints of meat may have been bought in from elsewhere.

Cattle

The mortality data are consistent with a cull of cattle at all ages (Tables 3 and 4), although the tooth-wear data provide more nuance, with peaks of very young animals in the first six months of life at wear stages A and B, subadult animals bred for meat at wear stages D and E, and older animals at wear stages GH, H and J that represent old adult and elderly cattle used for secondary products such as traction, milk and breeding. A single pelvis was complete enough to indicate the presence of a male animal, and pathological changes to another pelvis including eburnation and bone growth may be age-related. A tibia had massive bone growth surrounding the shaft in response to an infection to the upper hind leg, and a third molar was recorded with a reduced posterior column that is a congenital trait.

Sheep/ goats

Sheep/ goats were more likely to be culled at younger ages, with a large proportion of subadult animals culled before the late-fusing bones could fuse (Table 3), and between wear stages C and F (Table 4), which imply that most animals were culled at prime meat age. The presence of a few older animals at wear stages GH and H indicates use for wool and possibly milk and breeding. A sheep horn core had a 'thumbprint' indentation close to the tip, which may be related to a period of malnutrition (Albarella 1995).

Pigs

Pigs were primarily culled for meat, with no old adult animals present (Tables 3 and 4). This is a typical pattern for an animal that has little use for secondary products beyond breeding. Several canines were recorded, four of which came from females and seven from males.

Other mammals

Equids, canids and cats were recorded in low numbers (Table 1), which reflects their presence as non-food animals amongst deposits largely consisting of food waste. An equid mandible was likely to be from a horse rather than a donkey, and several of the canid remains were positively identified as dogs rather than foxes. All equid and canid bones were fused, suggesting that they were adult when they died, being important for tasks such as transport, traction, herding and guarding. One complete dog femur came from a large, robust animal standing *c* 65cm tall at the shoulder, and a complete horse metatarsal was also relatively large for the period, having a wither's height of *c* 1.41m, a horse mandible included a bevel on the second premolar, indicating a bitted animal that would have worn a harness. Several cat bones and teeth were recovered, including adult and juvenile animals.

Birds

Domestic fowl dominated the bird assemblage, the period and morphology of bones suggest that these are all likely to be chicken rather than pheasant or guinea fowl. The absence of medullary bone from broken bones implies that none were in lay at the time of death (Driver 1982), although neither of the two chicken tarsometatarsi were spurred, which indicates the presence of hens (West 1982). Geese were next most commonly recorded, and these were of a size likely to be domestic birds. All the chicken and goose bones were from adult animals, with no evidence for chicks.

SUMMARY

This basic analysis of the animal remains has proved useful for characterising some aspects of Saxo-Norman life in Lyminge. Deposits are typical of the deposition of general refuse, largely made up of the remains of table waste. The relatively high proportion of pigs, red-deer long-bones and diverse bird taxa is consistent with a diet of some status, and the predominance of meat-bearing long bones further implies that those living nearby enjoyed good-quality joints of meat. Much of the meat came from cattle, sheep/ goats and pigs nearing maturity, or young adults, kept purely for meat production. The presence of a few older cattle and sheep/ goats reflects the importance of these animals to the wider economy, for traction, milk, wool and breeding.

The porous bones of perinatal cattle, sheep/ goats and pigs imply that they were bred close by, although it is possible that very young animals were consumed as delicacies. It is also likely that chickens and geese were kept in the area. Wild animals including the deer, duck, gull and fish would have been hunted or bought in. Horses and dogs would also have had roles vital to other aspects of life and may have had close working relationships with those living close by.

Table 1. Species represented from Saxo-Norman contexts. Percentage given of total number cattle, sheep/ goat and pig remains

Taxa	N	%
Cattle	289	38
Sheep/ goat	305	41
Sheep	5	
Goat	3	
Pig	162	21
Equid	15	
Canid	6	
Cat	7	
Red deer	2	
Domestic fowl	21	
Bantam	1	
Duck	1	
Goose	12	
Gull	2	
Passerine	3	
?corvid	1	
Frog/ toad	107	
Gadidae	1	
?haddock	1	
Total identified	944	
Unidentified mammal	3928	
Micro-mammal	1	
Bird	11	
Fish	1	
Total	4885	

REFERENCES

Albarella, U 1995. 'Depressions on sheep horncores', *J Archaeol Sci,* **22**, 699–704

Davis, S 2000. 'The effect of castration and age on the development of the shetland sheep skeleton and a metric comparison between bones', *J Archaeol Sci*, **27(5)**, 373–90

Driver, J C 1982. 'Medullary bone as an indicator of sex in bird remains from archaeological site', in Wilson, Grigson and Payne, 251–4

Eisenmann, V 1986. 'Comparative osteology of modern and fossil horses, half-asses, and asses', in R Meadow and H-P Uerpmann (eds), *Equids in the Ancient World,* 67–116

Grant, A 1982. 'The use of toothwear as a guide to the age of domestic ungulates', in Wilson, Grigson and Payne, 91–108

Greenfield, H 2006. 'Sexing fragmentary ungulate acetabulae', in D Ruscillo (ed), *Recent Advances in Ageing and Sexing Animal Bones,* Oxford, Oxbow 68–86

Holmes, M 2018. *Southern England: A Review of Animal Remains from Saxon, Medieval and Post Medieval Archaeological Sites*, Portsmouth, Hist Engl Res Rep **08/2017**

Johnstone, C 2006. 'Those elusive mules: investigating osteometric methods for their identification', in M Mashkour (ed), *Equids in Time and Space,* Oxford, Oxbow, 183–91

Jones, G G and Sadler, P 2012. 'Age at death in cattle: methods, older cattle and known-age reference material', *Environ Archaeol,* **17**, 11–28

O'Connor, T 2003. *The Analysis of Urban Animal Bone Assemblages: A Handbook for Archaeologists,* York, Council for British Archaeology, The Archaeology of York **19/2**

Payne, S 1973. 'Kill-off patterns in sheep and goats: The mandibles from Asvan Kale', *Anatolian Stud,* **XXIII**, 281–303

Ratjen, H and Heinrich, D 1978. *Vergleichende untersuchungen an den metapodien von fuchsen und hunden,* Kiel, AZA

Schmid, E 1972. *Atlas of Animal Bones*, London, Elsevier Science Publishers

Serjeantson, D 1989. 'Animal remains and the tanning trade', in D Serjeantson and T Waldron (eds), *Diet and Crafts in Towns: The Evidence of Animal Remains From the Roman to the Post-Medieval Periods.* Oxford, BAR Brit Ser **199,** 129–46

Sykes, N 2007. 'Taking sides: The social life of venison in Medieval England', in A Pluskowski (ed), *Breaking and Shaping Beastly Bodies: Animals as Material Culture in the Middle Ages,* Oxford, Oxbow, 149–60

West, B 1982. 'Spur development: recognizing caponized fowl in archaeological material', in Wilson Grigson and Payne, 255–60

Wilson, B, Grigson, C and Payne, S (eds), 1982. *Ageing and Sexing Animal Bones from Archaeological Sites.* Oxford: BAR Brit Ser **109**

Zeder, M and Lapham, H 2010. 'Assessing the reliability of criteria used to identify post-cranial bones in sheep, Ovis, and goats, Capra', *J Archaeol Sci,* **37**, 2887–905

Zeder, M A and Pilaar, S 2010. 'Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, Ovis and goats, Capra', *J Archaeol Sci,* **37**, 225–42