FINDS FROM THE EVALUATION OF THE WEST CLOISTER WALK, LEOMINSTER PRIORY, HEREFORDSHIRE

Derek Hurst

With contributions by Ian Baxter, Julie Bowen, Sheila Hamilton-Dyer, Robin Jackson, Elizabeth Pearson, David Symons and Alan Vince

Illustrated by Carolyn Hunt

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Historic Environment and Archaeology Service,
Worcestershire County Council,
Woodbury,
University of Worcester,
Henwick Grove,
Worcester WR2 6AJ

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Part 1 Project summary

Analysis of artefacts from an evaluation on part of the former Leominster Priory site in 2005 was undertaken on behalf of the Friends of Leominster Priory. The earliest artefacts comprised a thin scatter of Mesolithic and Neolithic/Early Bronze Age flint, followed by a small amount of Roman material. Significant Anglo-Saxon deposits were defined and, though these were not productive of material culture, they did produce rich evidence for food consumption and diet, including indications of high status. Minimal evidence for the period of the medieval foundation of the priory and its operation was followed by substantial assemblages of building materials associated with the Dissolution period, and particularly of medieval floor tile which had probably been taken from the east end of the church. Subsequent activity on the site was associated with continuous deposition of finds on the site up to the 19th/20th century.

Part 2 Detailed report

1. Background

An evaluation was undertaken on part of the former Leominster Priory site in 2005, and this located significant archaeological deposits. It was directed by Bruce Watson as part of a Heritage Lottery Fund Local Heritage Initiative community project, and on behalf of the Friends of Leominster Priory. The finds are reported here in accordance with a proposal dated November 2007 (WHEAS 2007).

1.1 Aims

The principal aim of the project reported here was to carry out specialist reporting on a range of artefactual and ecofactual material from the evaluation in accordance with the agreed proposal (WHEAS 2007).

2. Methods

2.1 Artefacts

2.1.1 Artefact recovery policy

All finds were retained from fieldwork and have been processed as appropriate to their material type. Metalwork and other delicate materials have been carefully packaged and stored in appropriate ways, following First Aid for Finds (Watkinson 1987). The artefacts quantified and reported here comprise all finds from the 2005 evaluation stage of this project. None of the finds were, however, marked.

Environmental assessment

Samples were taken by the excavator from deposits considered to be of high potential for the recovery of environmental remains, and a total of three samples of Saxon date (82, 84, 86) were shown by previous assessment to merit further analysis (Mann and Pearson 2006).

Artefactual assessment

All artefacts had already been examined and dated to period. and *terminus post quem* dates produced for each stratified context. This date had been used during assessment (Hurst 2006) for determining the broad date of phases defined in the site stratigraphic sequence. The finds had been previously preliminarily identified and assessed (Hurst 2006).

2.1.2 Methods of analysis

Artefacts

New analysis was limited by the available budget. Further fabric identification of the pottery was undertaken with reference with the in-house fabric series (Hurst and Rees 1992; www.worcestershireceramics.org). Identification of building stone in consultation with the Earth Trust (formerly RIGGS) based at the University of Worcester was also undertaken, together with the specialist identification of the coins and a token. In the case of the ceramic floor tiles samples were sent to Alan Vince to characterise the clay source, and a quantified and contextualised discussion of the assemblage of the tiles was undertaken by Julie Bowen in the course of producing her BA thesis (Newport College, University of Wales). Additional work on other ceramic building materials, clay tobacco pipe, lithics, glass, and other metalwork was minimal, and for these materials existing data was summarised for publication.

Environmental

Two of the three samples that were assessed were subjected to further analysis, which included the identification of the fish and small mammal bones. These samples were processed by flotation followed by wet sieving using a Siraf tank. The flots were collected on a 300µm sieve and the residue retained on a 1mm mesh. This allows for the recovery of items such as small animal bones, molluscs and seeds.

The residues were fully sorted by eye and the abundance of each category of environmental remains estimated. The flots were fully sorted using a low power MEIJI stereo light microscope and plant remains identified using modern reference collections maintained by the Service. Nomenclature for the plant remains follows the *New Flora of the British Isles*, 2nd edition (Stace 1997).

3. Artefactual evidence

There were 29 standard boxes of finds comprising 1709 individual finds weighing 207.423kg (Table 1).

material	type	count	weight (kg)
pottery	Roman	3	0.026
	medieval	92	1.362
	post-medieval	248	2.355

	modern	38	0.239
	unidentified	1	0.015
building materials (ceramic)	Roman tile	2	0.388
	ceramic floor tile	539	82.057
	brick	55	15.223
	ceramic roof tile	31	1.335
	ceramic roof tile (ridge)	35	1.109
	fired clay	114	2.227
Building materials (stone)	stone (mainly roof tile)	85	79.481
	tufa	13	10.338
metals	iron	76	1.770
	copper alloy	16	0.075
	lead	11	0.173
	silver	1	0.001
clay pipe	stems	95	0.317
	bowls	8	0.077
glass	vessel	96	1.363
	window	58	0.246
other finds	mortar/plaster	53	2.250
	coal	1	0.010
	fuel ash slag	7	0.060
	flint	2	0.012
	working bone/antler	3	0.008
	oyster	21	0.270
ceramic objects		3	0.279
stone objects		2	4.357
totals		1709	207.423

Table 1 Quantification of finds

3.1 Lithics (*by* R Jackson)

There were two items of flint, both residual: a probably Mesolithic blade with one end snapped off and the other snapped/broken (41); and a Neolithic to Early Bronze Age naturally backed knife with fine invasive retouch and heavily used/damaged on one edge and the proximal end (63).

3.2 Pottery (*by* D Hurst)

Apart from a few sherds of Roman pottery the pottery assemblage mainly dated to the medieval period (24%), from the mid 11th/12th century but mainly being from the 13th/14th century onwards, and the post-medieval period (65%). Numeric fabric codes relate to the Worcestershire County fabric series (Hurst and Rees 1992), and alpha-numeric fabric ones to the Hereford fabric series (Vince 1985).

period	fabric code	Fabric common name	count	weight (g)_
Roman	12	Severn Valley ware	2	30
medieval	55	Worcester-type sandy unglazed ware	4	31
	57	Cotswolds unglazed ware	3	10
	66	Herefordshire glazed fine micaceous ware (Hereford A7b)	12	82
	69	Oxidized glazed Malvernian ware	71	1372
	71	Micaceous glazed ware	1	3
	81	German stoneware	1	3
	99	Miscellaneous medieval wares	1	15
Post-medieval	72	Brown glazed with flecks	1	5
	77	Midlands yellow ware	2	9
	78	Post-medieval red wares	36	449
	81.3	Nottingham stoneware	1	3
	81.5	White salt-glazed stoneware	6	33
	82	Tin-glazed ware	6	32
	83	Porcelain	4	10
	84	Creamware	34	164
	90	Post-medieval orange ware	2	17
	91	Post-medieval buff wares	85	911
	150	Deerfold/Lingen ware	36	1088
Modern	81.4	Miscellaneous late stoneware	7	74
	85	Modern stone china	54	248

Table 2 Quantification of pottery by fabric types

Roman

Two sherds of Severn Valley ware (contexts 6, and 62) were unusual finds for Leominster.

Medieval

The medieval pottery evidence spanned the whole medieval period, but was markedly commoner at the end of the period. There was a small amount of residual 11th/12th century Cotswolds ware (58), and this has also been noted elsewhere in Leominster in small quantities (Ratkai 1998). Another sherd (57) potentially of early medieval date was

handmade and distinctively tempered with ill-sorted quartz and occasional sandstone (sometimes with a black crystalline cement) – however, it could not be identified to a known fabric-type.

The 13th/14th century pottery was also relatively sparse as siltstone-tempered wares were not present and these have been shown to be the principal fabrics in this period. Some of the more micaceous wares (ie Hereford A7b; fabric 66) might be of this date, but the absence of Malvernian cooking pots, tends to confirm that 13th-14th century pottery is largely absent. From the 15th/16th century there is a much stronger presence, and as seen elsewhere in Leominster (Ratkai 1998) oxidised glazed Malvernian wares are the dominant type, followed by the Hereford A7b (fabric 66). A very small amount of 16th century Cistercian-type ware is indicated by brown-glazed cups (fabric 72).

period	fabric code	fabric common name	count	weight (g)
6	12	Severn Valley ware	1	13
	150	Deerfold/Lingern ware	18	798
	55	Worcester-type sandy unglazed ware	1	3
	66	Herefordshire glazed fine micaceous ware	1	9
	69	Oxidized glazed Malvernian ware	6	151
	77	Midlands yellow ware	2	9
	78	Post-medieval red wares	26	312
	81	Stonewares	1	3
	81.3	Nottingham stoneware	1	3
	81.4	Miscellaneous late stoneware	7	74
	81.5	White salt-glazed stoneware	6	33
	82	Tin-glazed ware	6	32
	83	Porcelain	4	10
	84	Creamware	34	164
	85	Modern stone china	54	248
	90	Post-medieval orange ware	2	17
	91	Post-medieval buff wares	82	888
5	150	Deerfold/Lingern ware	17	278
	55	Worcester-type sandy unglazed ware	1	8
	66	Herefordshire glazed fine micaceous ware	8	62
	69	Oxidized glazed Malvernian ware	57	1079
	71	Micaceous glazed ware	1	3
	72	Brown glazed with flecks	1	5
	78	Post-medieval red wares	10	137
	91	Post-medieval buff wares	3	23
4	150	Deerfold/Lingern ware	1	12
	55	Worcester-type sandy unglazed ware	1	17
	57	Cotswolds unglazed ware	3	10
	66	Herefordshire glazed fine micaceous ware	3	11
	69	Oxidized glazed Malvernian ware	8	142
	99	Miscellaneous medieval wares	1	15
3	55	Worcester-type sandy unglazed ware	1	3
2	12	Severn Valley ware	1	17

Table 3 Fabric summary of the stratified pottery sequence

Post-medieval

Pottery associated with the main post-Dissolution dump of floor tiles (46) was dated to the 17th century, suggesting that the dismantling of the priory buildings was taking place some while after the buildings were originally deserted. Of particular interest was some kiln furniture from pottery production (7) in the form of thin sandstone slabs, which had been used as spacers between pots during firing in the kiln. These have been previously seen as equipment used in by the Deerfold/Lingen potters in north Herefordshire. Products of this industry were also present, as on other sites in Leominster (cf Castle Moat site; Hurst 2002, 24-5). Apart from these local wares, the bulk of the pottery was the typical types of this period found elsewhere in the west Midlands, showing that Leominster was in no way isolated. Post-medieval pottery consisted of a relatively wide range of typical Midlands types including imported German stoneware, though the latter only in a very small quantity.

3.3 Clay pipes (*by* D Hurst)

A total of 103 pieces of clay pipe were found. There were eight bowls, which were all of 17th-18th century date, and which were all marked on the foot apart from one example. The initials marks were RE, IC, and WV (Table 4), and there was also a wheel-mark. The wheel-mark is common in Hereford (Thomas 2002, 99) and was dated by Oswald (1975) to 1650-90. Though a small assemblage there seemed enough to conclude that there was not a great deal of overlap with Hereford in the 17th century, so that localised production may have been the norm in this period.

It is noticeable that there is no clay pipe postdating the mid 18th century, and none of particularly early date.

initials	**Context (Period)**	**Hereford (Peacey & Shoesmith 1985)**		**Leominster Castle (Hurst 2002)**	
		reference	**date**	**reference**	**date**
RE	16 (P6)	M8.B5, no 41	1670-1710	fig 18, no 3	1690-1720
IC	7 (P6)	-	-	-	-
WV	23 (P5) 24 (P5)	-	-	fig 18, no 9	1640-60

Table 4 Clay tobacco pipe marks

3.4 Floor Tiles (*by* J Bowen)

With a note on the compositional analysis by A Vince.

Methods

Recording of the floor tile was carried out in accordance with Stopford (1990) and the report was originally compiled as a dissertation (Bowen 2007). Comparison was mainly made with the 19th century Leominster Priory collection made by Gilbert Scott (Hillaby and Hillaby 2006). The full report is available in archive (Bowen 2007).

The floor tiles

All the tiles were similar in general characteristics, with one exception (BW 30) which was of a different composition and size (see below).

Size

The normal shape was square measuring between 132–35mm with a thickness ranging from 22–25mm, the edges being bevelled.

Fabric

There was mainly a single fabric-type with very few inclusions. Thin-section and chemical analysis by Alan Vince (see Appendix) has indicated the tiles are 'Bredon-type' as are found across the Welsh Marches region.

Colour

Four colour groups were defined: black/dark green, green, amber, and yellow (Table 5). All the tiles were well-fired, showing a pink oxidised fabric around the edges with a grey reduced centre beneath the glaze. Six of the dark green/black pieces were uniformly grey throughout and appeared to have been over-fired. One unusual green/amber fragment had a distinct mottling in the glaze, suggesting the copper (colouring agent) may have been sprinkled on in powder form.

Of the 536 tile pieces recovered, 65 were decorated and the rest were plain.

glaze colour	**quantity**
dark green or black glaze	135
green glaze	81
green glaze over white slip	2
amber	16
light yellow colour over white slip	199
unknown	38

Table 5 Plain floor tiles quantified by colour

Wear

The majority of the tiles were well worn as the glaze was substantially or totally missing.

Mortar traces

The majority of the tiles were remarkably clean of mortar, although very slight traces were visible both on the sides and base of some of the tiles. Heavy deposits of coarse mortar would have been expected on discarded tiles and its absence may indicate the tiles had originally been only loose-laid on sand, although this would be unusual. Alternatively, the tiles may have been cleaned when lifted, ready for re-use.

Triangular pieces

Thirteen triangular pieces bear the marks where a square tile was sliced diagonally with a knife to half its depth before firing (*Figs 1-2*) and subsequently snapped in half to provide tiles to fill the edges of an area where square tiles are laid at 45 degrees.

Figure 1 Triangular tile made by splitting a rectangular floor tile in half

Figure 2 Unseparated triangular floor tiles

None of the yellow glazed tiles were sliced diagonally to produce triangular shapes, but seven pieces had been cut into quarters, presumably to complete specific designs.

Keying holes

Only five of the tiles bear 'keying holes' in the base of the tile. Such features were possibly to facilitate the firing process (Laurence Keen, pers comm). These were all a small square stabbed impression (*Fig 3*) as described by Eames (1980) for the only tile she attributed to Leominster.

Figure 3 Stabbed hole in base of floor tile

Stacking scars

Kiln stacking would have been made more difficult by the bevelled edges and some clues to the stacking were evident in stacking scars. On the Leominster tiles these were most usually at 45 degrees (Fig 4) suggest a packing pattern as suggested for Meaux Abbey (Yorkshire) tiles (Eames 1980) rather than that suggested for Cleeve Abbey (Somerset) tiles (Kent and Dawson 1998), the latter based on experimental work.

Figure 4 Stacking scar on bevelled edge of floor tile

Some of the tiles displayed a shallow cut, done on the bevelled edge of the tile at a 45-degree angle when the clay was wet. These may be accidental marks, or possibly assembly marks.

The decorated tiles

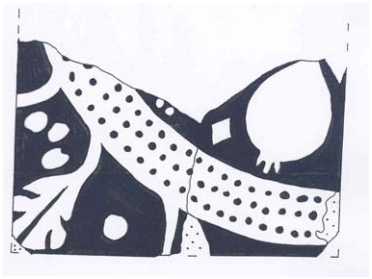
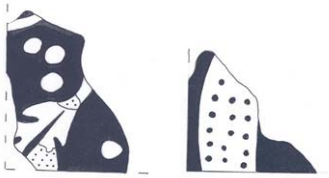
The Leominster tiles are displayed below in the left-hand column with illustrated parallels in the right-hand column (Fig 6). For a complete set of drawings of the decorated 2005 tiles see Bowen (2007) in archive. Most of the decorated tiles came from the context 46. Each piece has a number prefixed with 'BW' as a unique identifier to avoid any confusion with the tiles preserved in the late 19th century by George Gilbert Scott and subsequently drawn in the 1990s by Duncan Brown and Hilary White, the latter being prefixed with the initials 'GS'. Other tiles may be referenced 'BM' (the British Museum Collection, after Eames 1980) or 'PH' (the Parker-Hoare Collection; available on www.tileweb.co.uk).

The decorated tiles from the 2005 evaluation share only a few similarities with those found by Gilbert Scott, and are, therefore, likely to have come from a different part of the priory site. They probably originated from the eastern part of the church or other priory buildings which were dismantled after the Dissolution. The diverse designs are difficult to date accurately but probably belong to the 14th and 15th centuries. Some similar designs have been identified from across the country as shown in Figure 6, confirming that stylistic influences travelled broadly within the monastic communities, but a few of the designs also appear to be unique to Leominster.

Edging/infill strips

Ten decorated edging strips were recovered, plus one plain amber-glazed example. These are 15mm wide but their length is unknown. They would have been used either as a border, or to fill in any gaps due to inaccurate measurement of the surface to be floored.

Figure 5 Decorated infill strips

Leominster Tiles		Parallel Designs
   	Tiles **BW 1-4** probably formed part of a four-tile design, which could have been expanded as required. The white circular border with the three rows of small black dots is worthy of note. It would have been very difficult to create a wooden stamp to produce this design, but with a soft metal such as lead, these small dots could have been easily produced with a blunt spike. A lead stamp would have been mounted on to a wooden board to impress the design. Dr Laurence Keen has identified the "fruit" as a rosehip and provided two reference tiles (*Figs 6.1 and 6.2).* Alternatively a resemblance to a fig can also be suggested (Derek Hurst, pers comm). The design is similar to a four-tile pattern shown in Eames (1980) where the stubby stalks break out into stylised leaves in the outer ring of tiles, but the rosehips here have taken the form of a central flower (*Fig 6.3*). Also at Gloucester Cathedral.	 *Fig 6.1 Lacock Abbey, Wilts (courtesy of Dr Keen)*  *Fig 6.2 St Mary's, Glanville's Wootton, Dorset;* *St Eustace's, Ibberton, Dorset;* *St Laurence's, Holwell, Dorset;* *15th/16th century (Emden 1977)*  *Fig 6.3 Meaux Abbey (BM 2987-90)*

Leominster Tiles		Parallel Designs
    BW8 	**BW 5-8** has a heart motif at its centre. This may be construed as the 'sacred heart', the symbol of the Virgin Mary, and may have been laid as the floor to the Leominster Lady Chapel at its construction in the 14th century. Beyond the heart is a white circular strip which is then separated from a series of fleurs-de-lys by a concentric band of diamond shapes. A chevron border encircles the fleurs-de-lys, with a possible stylised flower in the outer corner (BW 8).	

Leominster Tiles		Parallel Designs
  	**BW 9-11** have a fleur-de-lys in each corner with double interlocking white lines as shown Fig 6.4. This design could be continued to fit any size of floor as in the panel assembled and displayed in the British Museum with tiles from St George's Church in Fordington, Dorset (*Fig 6.5*). Also at: Lacock Abbey, Wilts (L Keen, pers comm)	 *Fig 6.4 Maxstoke Priory, Warwicks; 14th century (BM 2561)*  *Fig 6.5 St George's, Fordington; 16th century (Eames 1980)*

BW 17

BW 12-19 form the most complex group, as three pieces (nos 12, 13, 16) retain angled sides. This design is identical to the Gilbert Scott tile GS21.

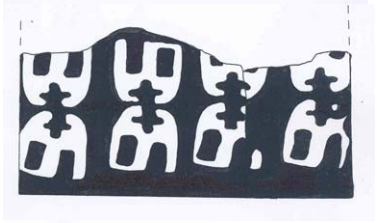
A border of five-petalled Tudor roses is encircled by an outer single white line. Inside this, a concentric design of two widely spaced lines cross over within a square to coincide with the outer Tudor roses. In between the square crossovers there appears to be a lozenge shape within the two lines.

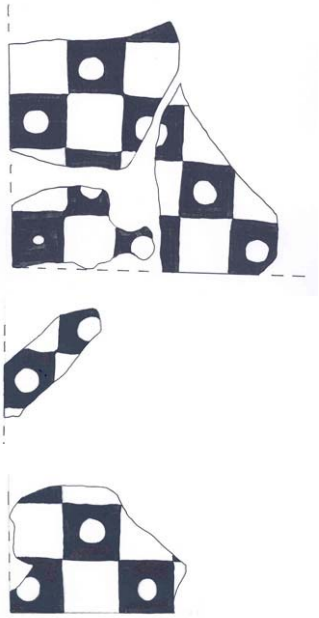
The only parallel for this crossover within a square is in a border tile, BM 1257 (*Fig 6.6*) found in the Westminster Chapter House.

BW 17 belongs with BW35.

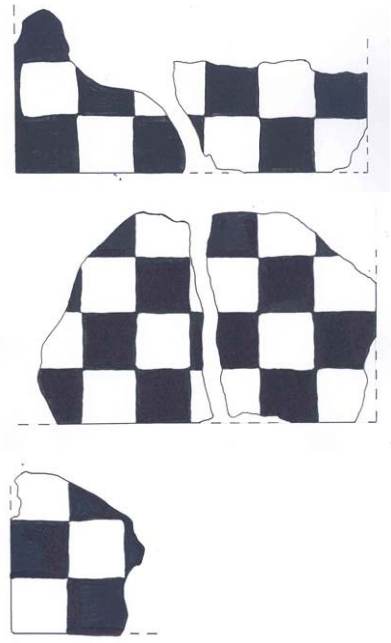
GS21

Fig 6.6 Westminster Abbey; 13th century (BM 1257)

   	**BW 20 – 22** appear to be unique to Leominster. It may be suggested these were produced by impressing the bit-end of a medieval padlock key (Judy Stephenson (Hereford Museum), pers comm*)*. It is clear that these imprints were made individually from the different juxtapositions on the tiles found. The use of a key may be linked symbolically with St Peter (one of Leominster's patron saints) as Keeper of the Keys to the Holy Gates.	



BW 23-25 would again appear to be unique to Leominster, having dots (or counters) within the black squares of a chequerboard design. Not known elsewhere (L Keen, pers comm).

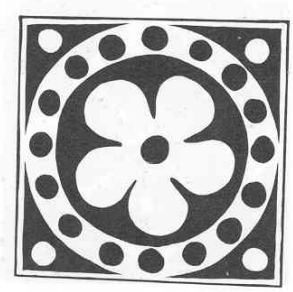
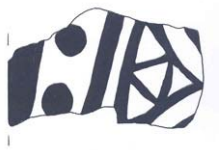


BW 26-28 bear the more common plain chequerboard designs which would probably have been laid between plain coloured tiles or single image tiles as shown in the *in situ* pavement at Titchfield Abbey, Hants (*Fig 6.7*).

Similar tile (GS24) found by Gilbert Scott.

Fig 6 .7 Titchfield Abbey, Hants; 14/15th century (Eames 1980)

GS24

	**BW 29** consists of three pieces of tile which clearly form part of an heraldic shield. Similar tiles were found by Gilbert Scott (GS24) and by Border Archaeology in 1992. Likely to be the checky-a-fesse arms of Clifford, a prominent Marcher family (Joe Hillaby, pers comm).	 GS24
	**BW 30** is of a different size (105mm square by 32 mm thick) and fabric composition to the other tiles excavated in 2005, and was the only complete tile found. It would appear to match one found earlier at Leominster by Gilbert Scott (GS4) and is similar to BM 2336 attributed to Whitland Abbey (*Fig 6.8*). Similar tiles have recently been recovered from the Commandery in Worcester (Griffin 2007), where a 14th century is suggested.	 GS4  2336 *Fig 6.8 Whitland Abbey, Carmarthenshire; 13th/14th century (BM 2336)*
	**BW 31** has exceptionally clean edges to its design. The complete design remains unknown.	

	**BW 32** is a much more detailed design containing stylised foliage with parallels in the Gilbert Scott tile series (GS22).	 GS22
	**BW 33** may feature script; the only other Leominster tile to display script features the Lombardic capitals on GS12. Few tilers would have been literate and the similarities with the mirror image of BM 927 (*Fig 6.9*) should not be discounted.	 GS12  *Fig 6.9 BM 927*
	**BW 34** may also be script	

BW 17

BW 35 appears to be a different design of stylised foliage and a cinque-foil between two concentric borders. The leaves are quite different from those in BW 12-19.

BW17 belongs to this design.

This design appears identical to one found in Dorset *(Fig 6.11)*.

This tile appears to match the description of a tile (fragment 7) found by Border Archaeology in 1992.

Fig 6.10 Great Malvern, Worcs (PH 2505)

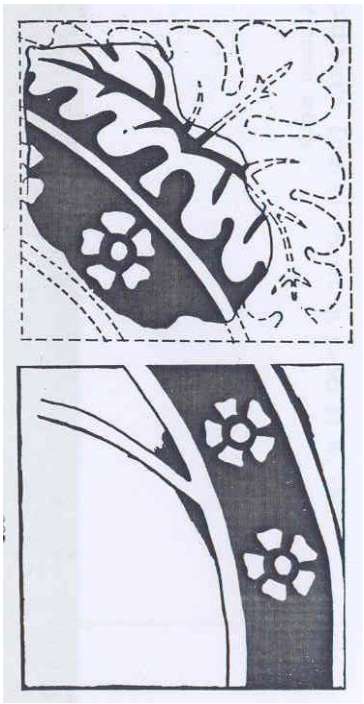


Fig 6.11 St Catherine's, Oborne, Dorset; 15/16th century (Emden 1977)

BW 36, although having the same two concentric borders, is a different design. The leaf shape echoes that in BW 12-19 but here the circles contain a central dot surrounded by three crescents each separated by two large dots. This close parallel is from Dorset *(Fig 6.12)*

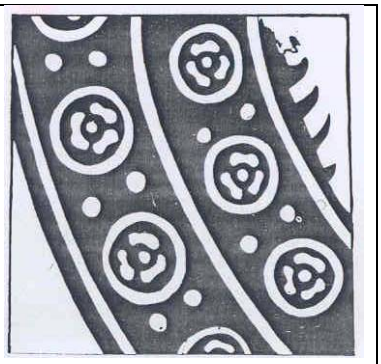


Fig 6.12 St Mary's Glanville's Wootton, Dorset; 15/16th century (Emden 1977)

BW 37 is likely to form part of a design as in BM 2565 attributed to Maxstoke Priory in Warwickshire (*Fig 6.13*).

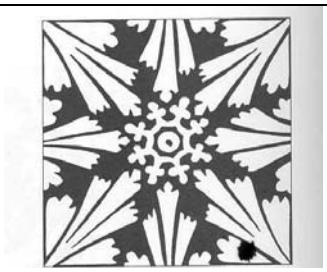
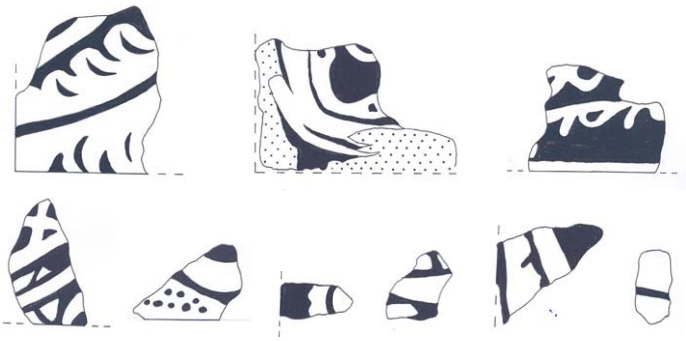


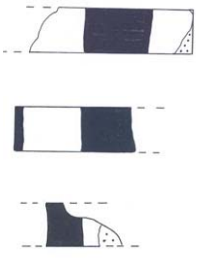
Fig 6.13 Maxstoke Priory, Warks; 14th century (BM 2565)

BW 38– 40 all share a chevron border but the fragments are too small to suggest a design.

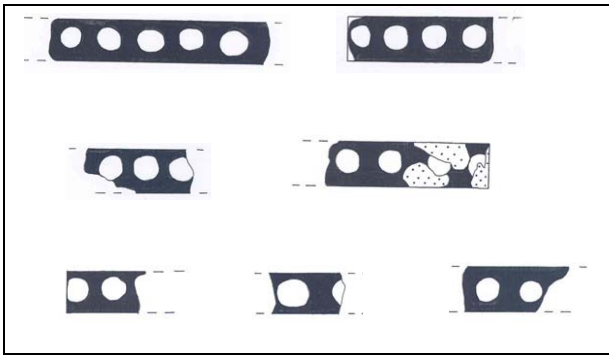


BW 41-49 are too small for any design to be identified.

The leaf design in BW 41 is similar to that in BW 35.



BW 50-52 are infill or edging strips 15mm wide in alternate black and white blocks. These may have been used with the chequerboard design to fill a gap where the floor was not quite square.



BW 53-59 are infill or edging strips with white dots, used in a similar manner to BW 50-52.

These were all made individually (ie not half scored and split).

Figure 6 Leominster decorated tiles from 2005 fieldwork and comparanda

The only tile within the British Museum Collection (Eames 1980) attributed to Leominster (*Fig 6.14*) features a double Tudor rose, but is otherwise unlike any other tile known from the site. An important feature of this single tile is that it is recorded as having five small square and stabbed keying holes in its base. The only keying holes found in the 2005 tiles appear to match this description.

Figure 7 Leominster tile in the British Museum Collection (Eames 1980)

Conclusions

It is notable that only five decorated fragments from the 2005 fieldwork resembled the tiles preserved by Gilbert Scott, strongly suggesting the latter came from a different part of the priory site not included in Scott's restoration which covered the south nave, the sanctuary, and the transepts. The 2005 tiles, therefore, probably came from the buildings to the east of the present church.

Some features indicated a more localised style of manufacture: for instance, the rare use of small keying holes in the base of the tiles , though only five examples were identified amongst 536 fragments, these 'holes' appearing too small to serve any useful purpose except as a signature, or marker perhaps, for a tile's position within a design. Much larger keying scoops in the base of tiles from elsewhere may indeed have been more functional for keying purposes. It is worthy of note that the only tile within the BM collection attributed to Leominster also featured five small square stabbed keying holes. Further research into such marks may prove useful in identifying individual artisans or their apprentices.

Some of the decorated tiles even appear to be unique to Leominster (Laurence Keen, pers comm), in particular the key-impressed tiles (BW 20-22) which have different juxtapositions of the image making it clear each tile was individually stamped with the die many times, in which case it is likely that only limited numbers would have been produced. The chequer-board pattern, with dots or counters within the black squares (BW 23-25), is also otherwise unknown, although the plain chequer-board design is commonly used, usually amongst plain tiles (Laurence Keen, pers comm). Localised tile-making is also indicated by not being able to identify any similar design to fit the group of irregularly shaped tiles BW 12-19 (Fig 8).

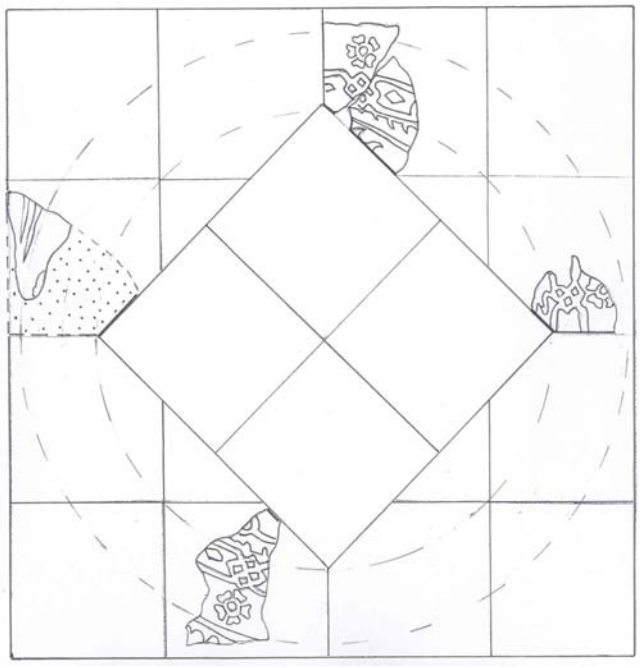


Figure 8 Laying pattern for tiles BW 12-19

Also of particular interest were the infill or edging strips BW 50-59 (Figs 5-6). These were not half-scored and snapped, as were the triangular pieces from the site, but instead were individually made. These were all 15mm wide but no complete lengths were found, and have both white dots on a dark background and alternate dark and light squares. Such strips were certainly labour intensive to produce and their purpose may have been to form part of the overall plan, forming a border around or between designs, or possibly they were specifically manufactured to fill a gap if an imported floor design did not quite fit the intended floor space. Such small strips are unlikely to have been of much interest to the salvage workers following the Dissolution.

Taking a broader view of the tiles other stylistic attributes may be useful for cross-linking different sites, thus potentially connecting kiln sites with specific potters, or tile-making traditions. Such would include the glazing scars on the sides of the tiles, which are useful for indicating the stacking pattern within the kiln.

Dating

As these tiles were a secondary deposition, evidence of their date of manufacture was more problematical. Plain tiles are inherently difficult to date and no plain tiles for comparison survived from the Gilbert Scott restoration. In general the range of glaze colours on the 2005 plain tiles was unexceptional; the high proportion of large plain yellow tile fragments, followed by plain dark green ones, may indicate a predominance of a simple chequer-board laying pattern, and the absence of any yellow triangular pieces tends to confirm this.

The decorated tiles offered more dating evidence. Of the Gilbert Scott tiles, the earliest were the Chertsey Group, dating to the 13th/14th centuries, and the Bredon Heraldic Group dated to a similar period. The smaller and simpler tiles found extensively in the Worcester area are dated to the 14th/15th centuries, whilst the larger nine or sixteen-group designs were later still, and dated into the 15th/16th centuries. The fragments of floor tiles from Leominster Priory, therefore, spanned 300 years between the 13th–16th century.

The 2005 tiles included none of the earlier Chertsey style, and only one of the smaller-sized Worcester group. Only three heraldic pieces were found, possibly linked to the Bredon group. The more elaborate sixteen-tile design with the angled inset (as BW 12-19; Fig 8)

probably belonged to the 15th/16th centuries. On balance, therefore, it is thought the bulk of the tiles discovered in 2005 are more likely to belong to the later period.

Circumstances of deposition

As only fragments of tile were found it is likely that the assemblage reported here represents the remnants of a 'demolition yard' following the dissolution of the Priory in 1539, after which much of the Priory was demolished, and any reusable building materials processed sorted for resale. However, despite local enquiries no incidence of the reuse of this material at other sites could be demonstrated.

Production source

The wide range of designs and the parallels identified from across Britain (Fig 6) confirm that the Leominster Priory was part of the wider monastic community and open to diverse influences. However, the several designs unique to Leominster, in particular the key-impressed tiles, also seem to indicate the presence of an innovative and imaginative craftsman working more locally to Leominster. Significantly Archenfield Archaeology recently discovered unglazed tile wasters, of a similar composition to the 2005 floor tiles, during rescue archaeology on a superstore building site directly across the river from the priory. Here many waster unglazed floor tiles were found of a similar composition forming a raised walkway through marshy ground (Huw Sherlock 2007, pers comm). This represents good evidence for a nearby kiln site. Quantities of iron slag were also found on this site, suggesting that this was also the site of other industrial activities, separated from the monastic community by the river.

Compositional analysis (*by* A Vince)

Thin-section and chemical analysis indicated that a typical tile (green-speckled glaze and unslipped; from 46) from the site assemblage is probably a Bredon-type tile, produced in the Hereford area, which is central to the distribution across Herefordshire, south Shropshire, and Gloucestershire. Such tiles survive in the priory church at Leominster and some of those tiles were decorated with dies which occur on tiles found in Hereford (Vince 1985). When compared with samples of a group of Bredon-type tiles from Abbey Dore (Vince 1997) it is possible to distinguish the Leominster and Abbey Dore groups and this suggests that the two groups of tile were produced as separate batches.

These studies suggest that the tile is a Bredon-type tile (Vince and Wilmott 1991) for which a source in Hereford has been suggested. For the detailed report see Appendix.

3.5 Other building materials (*by* D Hurst)

Stone

A high proportion of the substantial quantity (*c* 90kg) of building stone was flat roofing tile in a fine homogeneous red laminar sandstone, which was clearly widely available locally in the medieval period in the adjacent town (Roe 1998). None of this tile was complete enough to record tile dimensions, and thickness (and size) probably varied according to the position of the tile on the roof. It was all found in association with Dissolution or later deposits except for a piece from Phase 3 (67). Similar tilestone has been previously recovered in large quantities during excavations in the town, where they have been identified as Old Red Sandstone St Maughans Group or Dittonian, and attributed to the Queens Wood quarry on Dinmore Hill about 6km to the south (Roe 1998). The only other type of tilestone was a fine green sandstone (weathering to light grey; 46, P5) which seemed finer and was used for some rather thin slates, though this was rare by comparison.

Tufa was associated with Phase 3 and 4 deposits, presumably implying its use in building in this period; it was widely used, for instance, in church building in the Norman period

(Leonard 2000, 8), and is likely to have been quarried at Southstone Rock 20km to the east in Worcestershire.

The Dissolution deposits also contained some slightly coarser red sandstone (23).

Mortar and plaster

There were 53 pieces of mortar and plaster, none of the latter showing any signs of being painted. The mortar was sometimes exhibited a small aggregate admix of stone pellets. The use of crushed tile as the aggregate, as in Roman *opus signinum*, was noted in occasional pieces (41, 73), which was the same mortar as on the Roman-style box-flue tile (see below).

Window glass

There were 58 shards of plain window glass which were all from Periods 5 and 6. These were composed mainly of thin (1mm thick) glass with a pale green tinge, but there were also pieces up to 3mm in thickness. The thicker glass was often non-transparent, and its original appearance remained uncertain; it tended to be in a more fragile condition than the other window glass. A melted globule of green glass (5) was also noted from Period 5.

Ceramic roofing tile

Almost all of the roofing tile was derived from Dissolution (Period 5) and later deposits. The majority of fragments from these deposits were from glazed ridge tiles, and at least three sources were represented: Malvernian, a sandy (?Worcester-) type, and a fabric similar in composition to the majority of the floor tiles, as well as resembling some of the pottery (fabric 66/Hereford A7b). The latter was the commonest type, and normally had a golden glaze with pronounced green mottling, which was also similar in outward finish to Hereford A7b (fabric 66) pottery. Some of the Malvernian ridge tile was remarkable for its thinness (10mm; eg context 40), and this characteristic has been noted elsewhere (Hurst forthcoming); its main advantage possibly being cheaper carriage, especially overland, given the associated weight reduction. No definite ceramic flat roof tile was recorded, as no nibbed or peg-holed pieces were observed.

Other ceramic tile

There was a single piece of a Roman box-flue (*tubulus*) tile (76, P3) which featured *opus signinum* mortar perhaps indicating that it probably originated from a Roman bath-house.

Bricks

The bricks all came form Dissolution and later deposits. The thinnest bricks were 2-inches (50mm; 7, P6) or 2¼-inches (57mm; eg 24, P5), and their fabric seemed to be different to the commonest medieval ceramic of the floor tiles and roofing tiles, suggesting a different industry for this new type of building material, which had probably been introduced in the region at a relatively late date.

Fired clay/daub

The majority of the 114 fragments of fired clay were from Period 3 deposits, and some of it displayed signs of wattling, probably indicative of its being a building element rather than from some more ancillary structure such as an oven. The clay used such purposes would normally be quite local, and, on a superficial comparison, it was not unlike the clay used for floor tiles in the medieval period, which may support this supposition of a local source for this material.

3.6 Glass vessels (*by* D Hurst)

All the vessel glass was from green bottles associated with Period 5 and 6 deposits, except for a pale blue small shard (20, Period 6). The green glass material was very fragmentary but could be seen to belong to bottles typical of the 17th-18th centuries, with the bulk of the shards probably dating to the earlier part of this date range.

3.7 Metalwork objects (*by* D Hurst)

For coins see separate section below.

Ironwork

The ironwork consists mainly of nails, and a smaller number of other objects. The condition of the objects was generally poor indicating that they had come from well-aerated deposits, and so identifications often tended to remain problematic. Only the most identifiable objects from medieval and earlier deposits (pre-Period 6) are listed here, unless otherwise stated, following radiography at the York Archaeological Trust Conservation Laboratory (identifications of nos 2-6 are by Felter 2007; detailed report in archive), and omitting nails.

Figure 9 Iron objects

Fig 9

1 Fish-hook; 84, subgroup 7, P3 (not radiographed)

2 ?Tip from a long bow with traces of non-ferrous plating (cf Ottaway and Rogers 2002, no 2969); context 70, subgroup 5, P3 (illustration based on radiograph)

Not illustrated

3 ?Buckle fragment ('D'-shaped cf examples from London dated to 1350-1400; Egan and Pritchard 1991, 91); context 67, sub group 4, P3

4 U-shaped staple (or possible wall-hook; D Hurst, pers comm); context 58, subgroup 19, P4

5 Horse-shoe fragment; context 40, subgroup 22, P5

6 ?Strap-end fragment; context 45, subgroup 22, P5

Copper alloy objects

All the copper alloy objects were from Dissolution (Period 5) and later deposits, and were mainly small pins and buttons.

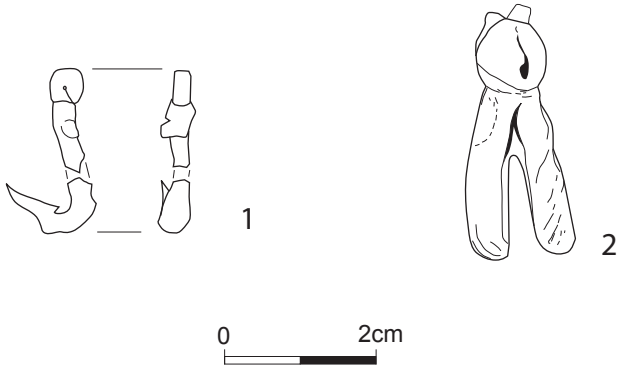
Lead objects

All the lead was from Dissolution (Period 5) and later deposits, except for a single small medieval waste piece (64). The Dissolution and later lead was mainly sheet off-cuts.

3.8 Coins (*by* D Symons)

From context 1 (Period 6)

1 A copper halfpenny of George III (1760-1820), dated 1799. Weight 12.18g. This coin is somewhat corroded, but relatively lightly worn, and it is likely that it was deposited within the first decades of the nineteenth century.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2
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2cm

2 A copper disc. Diameter 27mm, weight 6.21g. Possibly originally a late eighteenth-century or early nineteenth-century halfpenny coin or token, but if so now worn completely flat.

Two other coins (19th century and later pennies) – not examined.

From context 23 (Period 5)

3 A copper farthing token of the mid-17th century, issued by Roger Smith, mercer, of Weobley, Herefordshire. Corroded, but exhibits relatively little wear. Diameter 15mm, die axis 0°, weight 0.67g.

Obverse: (star) ROGER (rosette) Smith (pellet)

The Grocers' Arms (Argent a Chevron Gules between nine Cloves Sable).

Reverse: (rosette) (star) (rosette) (star) OF (rosette) WEBLY

In the field, (rosette) S (rosette) / RA.

(Five-pointed stars and four-petalled rosettes.)

Figure 10 Weobley token

This token appears to be a hitherto unrecorded type (Fig 10). The only tokens previously known for Weobley are a halfpenny of 1659 issued by James Clarke, a mercer (Williamson 1889-91, 292 no 72 / Dickinson 1986, 71, no 72), and a halfpenny of 1667 issued by Richard Clark, also a mercer (Williamson 1889-91, 292, no 73 / Dickinson 1986, 71, no 73).

The use of a triangle of initials on the reverse of such tokens is quite common. The upper one represents the family name, the lower left the husband's first name and the lower right the wife's first name (in this case probably Ann).

The earliest known 17th-century tokens were issued in or near London at the very end of the 1640s, but their use spread fairly rapidly across the whole country and they were issued in many localities during the 1650s and 1660s. They were issued for local use (Weobley is only 10 miles south-west of Leominster) by a variety of tradesmen and town corporations to make good a shortage of regal small change. Their use was banned by a royal proclamation of 24 August 1672 which accompanied the issue of new, large-size copper halfpennies and farthings by the government (Dickinson 1986, 5, 262-3). This particular specimen is undated, but it is unlikely to have been struck before the early 1650s and this provides the earliest likely date for its deposition. How late it might have been deposited is a little more problematic. If lost during its period of circulation, then the latest date of deposition must realistically be late 1672 or early 1673, and this is probably the most likely date in this case.

However, once their use was forbidden, such tokens became effectively valueless and the possibility has to be kept in mind that they may have been preserved as curiosities or playthings and only lost well after the 1670s.

From context 41 (Period 4)

4 A silver halfpenny of Henry VI (1422-61), London mint, Annulets issue (1422-7), North (1991, 75) 1434. Maximum diameter 14mm, die axis 250°, weight 0.39g. This coin has seen some wear, but not a great deal (Fig 11). Although the weight is low enough for it technically still to have circulated after the weight reduction carried out in 1464 by Edward IV, when the theoretical weight of the halfpenny was reduced from 7.5 gr (0.49g) to 6 gr (0.39g), it seems more likely that it was deposited at some time in the second quarter of the 15th century. (Since lower value coins generally passed from hand to hand more speedily one would expect a halfpenny that had been in circulation for some forty years to exhibit more wear than is the case here.)

Figure 11 Silver halfpenny of Henry VI (1422-61)

3.9 Miscellaneous other finds (*by* D Hurst)

Other miscellaneous artefacts were:

quenstone/millstone (41), very weathered and fragmentary; made from a conglomerate from the Old Red Sandstone, a type of stone typically used for this purpose in this area;

a ‘pot-lid’ (23) of 115mm diameter made from laminar red sandstone identical to that widely used for roofing tile;

a ‘pot-lid’ (46; Fig 12) of *c* 100mm diameter made from a medieval floor tile the upper surface of which was completely worn away, possibly suggesting that this was the re-use of a tile discarded during the replacement of part of a pavement;

a wig-curler (1);

a slate pencil (1);

A small amount of material representing pyrotechnical activity comprised: a tiny amount of white-metal casting waste (84, Period 3); coke (58, Period 4), vitrified clay from Dissolution deposits (40, 45; Period 5), and ash and fuel ash slag from Period 6.

Figure 12 'Pot-lid' made from a medieval floor tile

3.10 Overall discussion of artefactual evidence (*by* D Hurst)

The artefactual assemblage from the site is notable for the presence of Roman finds (possibly in a Roman context - 62), and for the significant medieval floor tile group from context 46. The *tpq* dating of this particular context to the 17th century (based on associated pottery) seems to imply that at least some of the dismantling of priory buildings took place a generation or more after the act of Dissolution.

The substantial assemblage of building materials included tile, brick, mortar, plaster and stone. This accumulation clearly related to the dismantling of the buildings following the Dissolution. Metalwork, largely consisting of nails, presumably also derived from this general process of dismantling the priory buildings. All the window glass was also found within post-medieval contexts.

Speaking more broadly the site assemblage represents a valuable addition that supplements other sizeable assemblages from the town excavated under modern conditions, such as that from the Buttercross (Hurst *et al*, 1998). In particular there was a wide range of building materials which would be useful for reconstructing aspects of the original buildings and decor now lost, such as the decorative floors that may have adorned the east end of the church.

4. Environmental evidence

4.1 Animal bone (*by* I Baxter)

Introduction

A total of 583 'countable' (see below) fragments of animal bones were recovered by hand-collection (Table 6) from Periods 3-5. The bones were in the main well preserved. Over 60% of the material recovered dates from the Anglo-Saxon period and this is the main focus of this report. Only a small number of medieval fragments were found. Because of the wide date range of the Dissolution material only the numbers of fragments per taxon have been recorded. For detailed report see the archive (Baxter 2008).

Methods

All of the animal bones reported here were hand-collected (for bones from samples see S Hamilton-Dyer, this volume). Consequently an under-representation of bones from the smaller species is to be expected.

The mammal bones were recorded on an Access database following a modified version of the method described in Davis (1992) and Albarella and Davis (1994). In brief, all teeth (lower

and upper) and a restricted suite of parts of the skeleton were recorded and used in counts. These are: horn-cores with a complete transverse section, skull (zygomaticus), atlas, axis, scapula (glenoid articulation), distal humerus, distal radius, proximal ulna, carpal 2+3, distal metacarpal, pelvis (ischial part of acetabulum), distal femur, distal tibia, calcaneum (sustenaculum), astragalus (lateral side), centrotarsale, distal metatarsal, proximal parts of the 1st, 2nd and 3rd phalanges. At least 50% of a given part had to be present for it to be counted.

The presence of large (cattle/horse size) and medium (sheep/pig size) vertebrae and ribs was recorded for each context, although these were not counted. 'Non-countable' elements of particular interest were recorded but not included in the counts. For birds the following were always recorded: scapula (articular end), proximal coracoid, distal humerus, proximal ulna, proximal carpometacarpus, distal femur, distal tibiotarsus, distal tarsometatarsus.

The separation of sheep and goat was attempted on the following elements: horn-cores, dP3, dP4, distal humerus, distal metapodials (both fused and unfused), distal tibia, astragalus, and calcaneum using the criteria described in Boessneck (1969), Kratochvil (1969), Payne (1969 and 1985) and Schmid (1972). The shape of the enamel folds (Davis 1980; Eisenmann 1981) was used for identifying equid teeth to species. Equid postcrania were checked against criteria summarised in Baxter (1998a).

Wear stages were recorded for all P4s and dP4s, as well as for the lower molars of cattle, sheep/goat and pig, both isolated and in mandibles. Tooth wear stages follow Grant (1982).

Bone measurements are retained on the database. These in general follow von den Driesch (1976). All pig measurements follow Payne and Bull (1988). Humerus HTC and BT and tibia Bd measurements were taken for all species as suggested by Payne and Bull (1988) for pigs.

Frequency of species

Taxon	**Period**			**Total**
	3 **mid to late Anglo-Saxon**	**4** **Medieval** ***c* 1123-1539 AD**	**5** **Dissolution** **1539-early C18th AD**	
Cattle (*Bos* f. domestic)	101	14	105	**220**
Sheep/Goat (*Ovis/Capra* f. domestic)	45	6	35	**86**
Sheep (*Ovis* f. domestic)	(14)	(1)	(12)	**(27)**
Roe Deer (*Capreolus capreolus*)	2	+	-	**2**
Pig (*Sus scrofa*)	115	12	32	**159**
Equid (*Equus* sp.)	-	-	1	**1**
Horse (*Equus caballus*)	16	-	2	**18**
Dog (*Canis familiaris*)	-	-	2	**2**
Cat (*Felis catus*)	+	-	+	**+**
Domestic Fowl (*Gallus* f. domestic)	46	2	9	**57**
Greylag/Domestic Goose (*Anser anser*)	14	-	+	**14**
Goose (cf. *Anser albifrons/brachyrhynchus*)	1	-	-	**1**
Mallard/Domestic Duck (*Anas platyrhynchos*)	8	+	1	**9**
cf. Teal (*Anas crecca*)	1	-	-	**1**
Pigeon (cf. domestic/*Columba livia*)	1	-	1	**2**
cf Wood Pigeon (*Columba palumbus*)	5	-	-	**5**
Plover (cf. *Pluvialis apricaria/squatarola*)	1	-	-	**1**
Woodcock (*Scolopax rusticola*)	1	1	-	**2**
Passerine (*Aves* sp.)	-	-	1	**1**
Ling (*Molva molva*)	-	-	2	**2**
Fish (*Pisces* sp.)	-	-	2	**2**
Total	**352**	**35**	**196**	**583**

Table 6 Number of hand-collected mammal, bird, and fish bones (NISP). Sheep/Goat = also includes the specimens identified to species. Numbers in parentheses are not included in the total of the period. + = means that the taxon is present but no specimens could be 'counted' (see text)

The number of identified specimens (NISP percent) of the main food species recovered from the Anglo-Saxon deposits of Period 3 at Leominster is compared with a selection of Anglo-Saxon and medieval ecclesiastical sites in England in Figure 13. In common with most of these sites pigs and birds are a significant dietary element. At Leominster Priory chicken fragments are as numerous as those of sheep/goat the third most frequent domestic mammal species. The few remains recovered in the medieval deposits of Period 4 also contain a significant proportion of pig bones and teeth. In the post-Dissolution deposits of Period 5 cattle fragments dominate the assemblage, although pig remains are almost as numerous as those of sheep/goat (Table 6).

Insert Figure 13

Figure 13 Frequency of Food Species at Leominster Priory (Period 3), Herefordshire compared with other monastic sites

Period 3. Anglo-Saxon (Subgroups 2, 4, 5, 6, 7, 8 & 9)

Pig bones and teeth are the most frequent component of the Anglo-Saxon assemblage accounting for a third (33%) of all remains. Cattle are next frequent at 29% followed by wild and domestic birds combined at 21% and sheep/goat at 13%. Amongst the birds chicken alone accounts for 13% of the total. Equid remains amount to 4.5% of the total and roe deer 0.6%. Domestic cat is present although no specimens could be counted (Table 6).

Cattle

The only measurable cattle horn-core was recovered from pit 85 (84). This derived from a subadult short-horned beast and was sawn from the cranium. A metatarsal from 74 (subgroup 9) came from a small animal with a withers height of 100cm based on the multiplication factors of Matolcsi (1970). Very few cattle teeth were recovered but most of these belonged to dentally adult cattle (Table 7). Available epiphyseal ends of bones indicate that beasts with late fusing epiphyses unfused (ie subadults and young adults) comprise a significant proportion of the cattle assemblage (Table 10). In Figure 14 cattle astragali, from Leominster are compared with those from a number of other Anglo-Saxon and early medieval sites. The astragalus is a bone of significance as directly reflecting the live weight of the animal. The Leominster beasts tend to group towards the centre of the size plots (A and B) but to the right and away from the main grouping on the plot reflecting shape (C). This size independent variable suggests that the Leominster cattle largely derive from a population (or populations) genetically distinct from most of the other cattle with which they are compared. When the mean of the distal breadth (Bd) of the Leominster cattle astragali is compared with those from other sites it groups closest with those of similar date from Brandon Road, Thetford and Southampton (Figure 15). In Figure 16 the Leominster cattle astragali are compared with those from a selection of Anglo-Saxon and Medieval sites in Hereford, the Leominster bones tending to group to the right in all charts, suggesting that they derive from both relatively large as well as genetically distinct beasts.

Insert fig xxxx2 = Fig 14

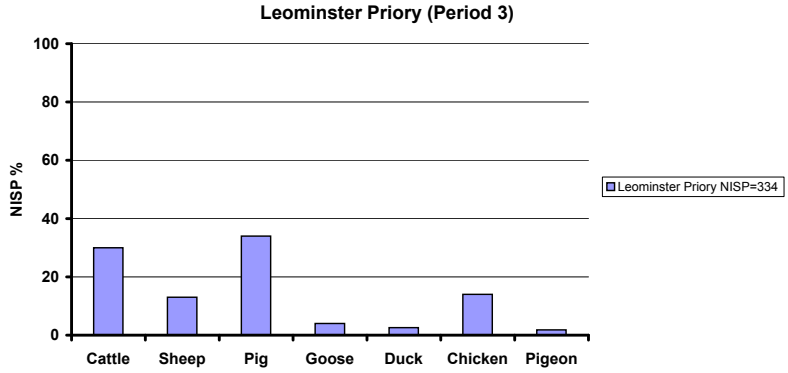
Figure 14 Size (A and B) and shape (C) of cattle astragali at Leominster Priory (Periods 3-4) compared with a selection of Anglo-Saxon and early medieval sites

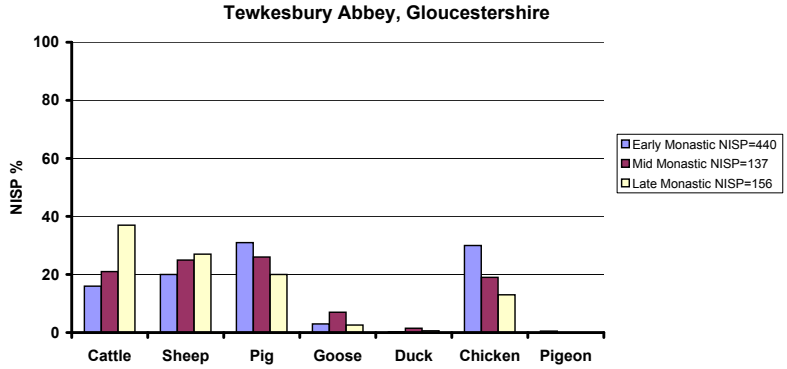
Insert fig xxxxx3 = Fig 15

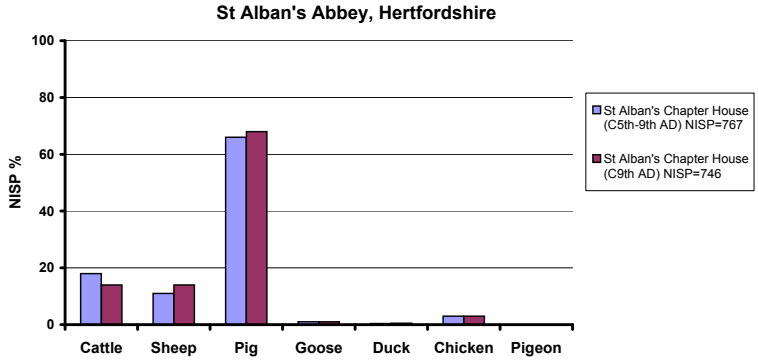
Figure 15 Range and mean of Periods 3-4 cattle astragalus measurements at Leominster Priory, compared with a selection of Anglo-Saxon and early medieval sites

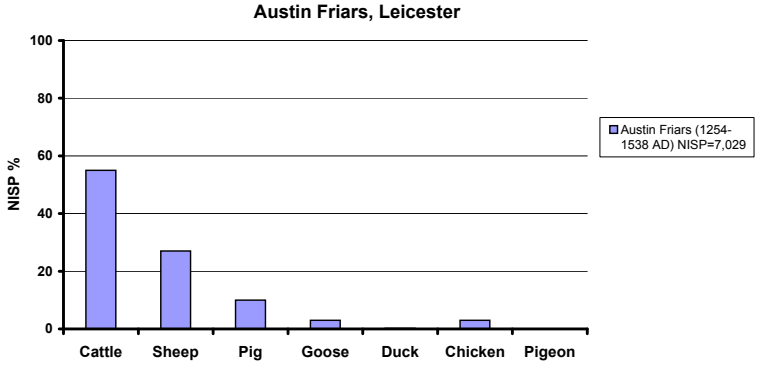
Figure 13 Frequency of Food Species at Leominster Priory (Period 3), Herefordshire compared with other monastic sites

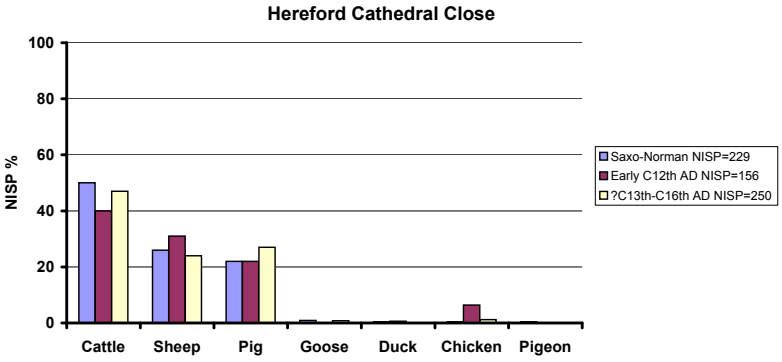
Tewkesbury Abbey based on Baxter (2007); Chapter House, St Alban's Abbey based on Crabtree (Unpublished); Austin Friars, Leicester based on Thawley (1981); Hereford Cathedral Close based on Baxter (Forthcoming); Ramsey Abbey, Cambridgeshire based on Baxter (1998).










Hereford Cathedral Close
NISP %
100
80
60
40
20
0
Cattle
Sheep
Pig
Goose
Duck
Chicken
Pigeon
Saxo-Norman NISP=229
Early C12th AD NISP=156
?C13th-C16th AD NISP=250

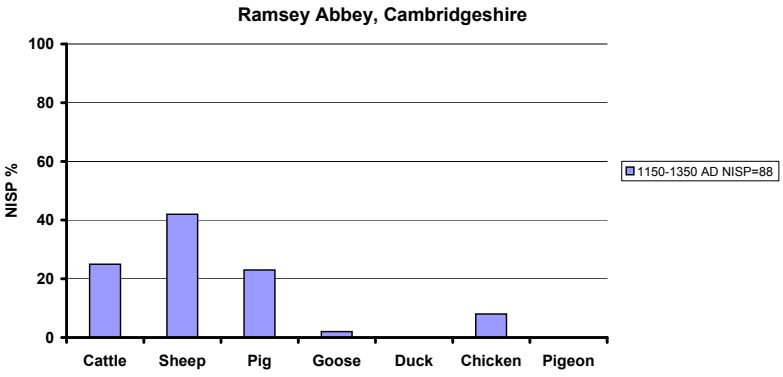

Ramsey Abbey, Cambridgeshire
NISP %
100
80
60
40
20
0
Cattle
Sheep
Pig
Goose
Duck
Chicken
Pigeon
1150-1350 AD NISP=88

Figure 14 Size (A and B) and shape (C) of cattle astragali at Leominster Priory (Periods 3-4) compared with a selection of Anglo-Saxon and early medieval sites

Measurements in tenths of mm.

Millbridge, Railway Street and Covered Market, Hertford based on Baxter (2001); Mill Lane, Thetford based on Albarella (1999; 2004); Castle Mall, Norwich based on Albarella et al. (1997); West Cotton based on Albarella and Davis (1994); Brandon Road, Thetford based on Baxter (2005).

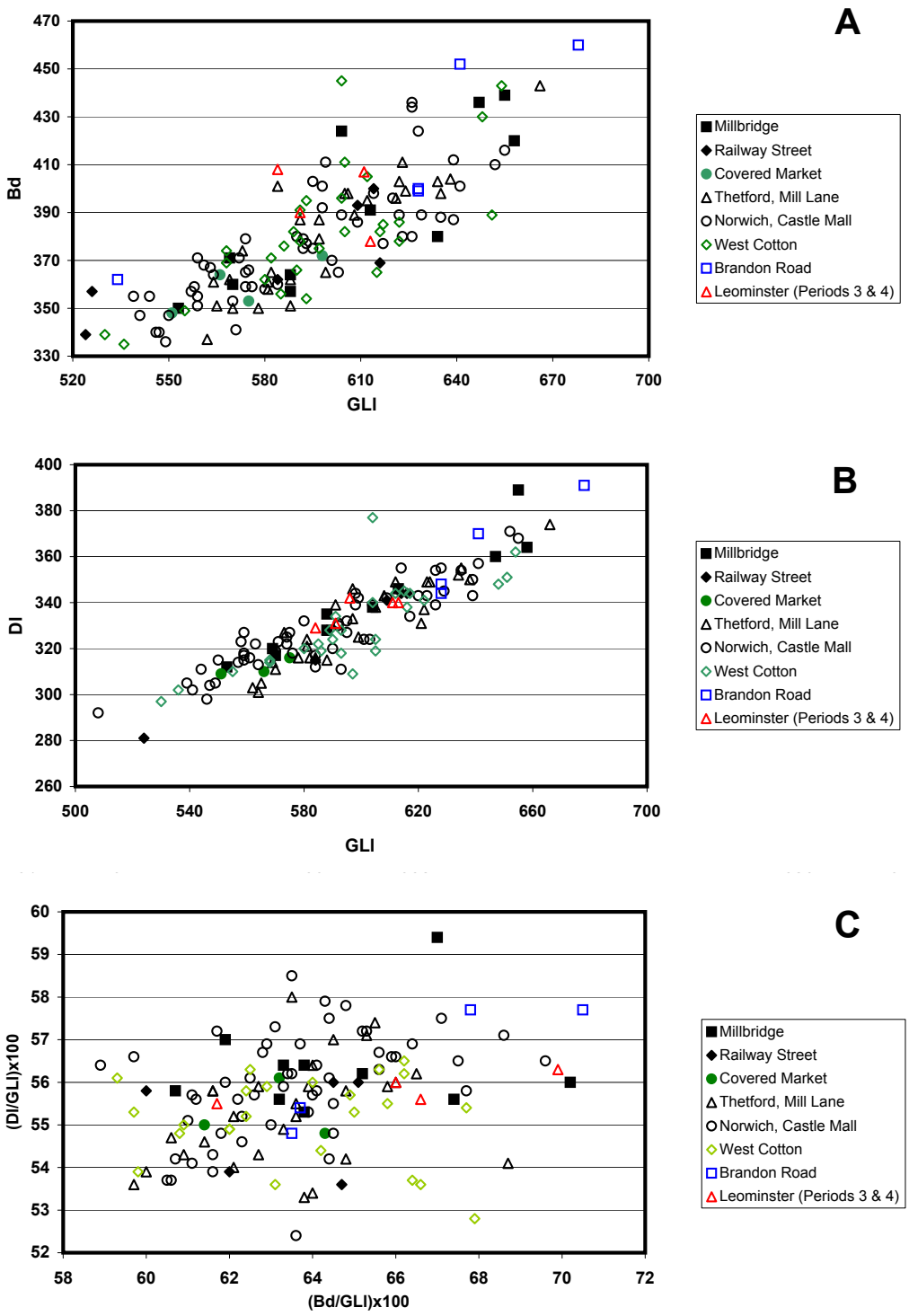


Figure 15 Range and mean of Periods 3-4 cattle astragalus measurements at Leominster Priory, compared with a selection of Anglo-Saxon and early medieval sites

Hertford Central = Millbridge, Railway Street and Covered Market combined.

CM=Castle Mall; ML=Mill Lane; BR=Brandon Road; MS=Melbourne Street.

Sample sizes are as follows:

Astragalus 26, 61, 32, 19, 35, 6, 172, 4.

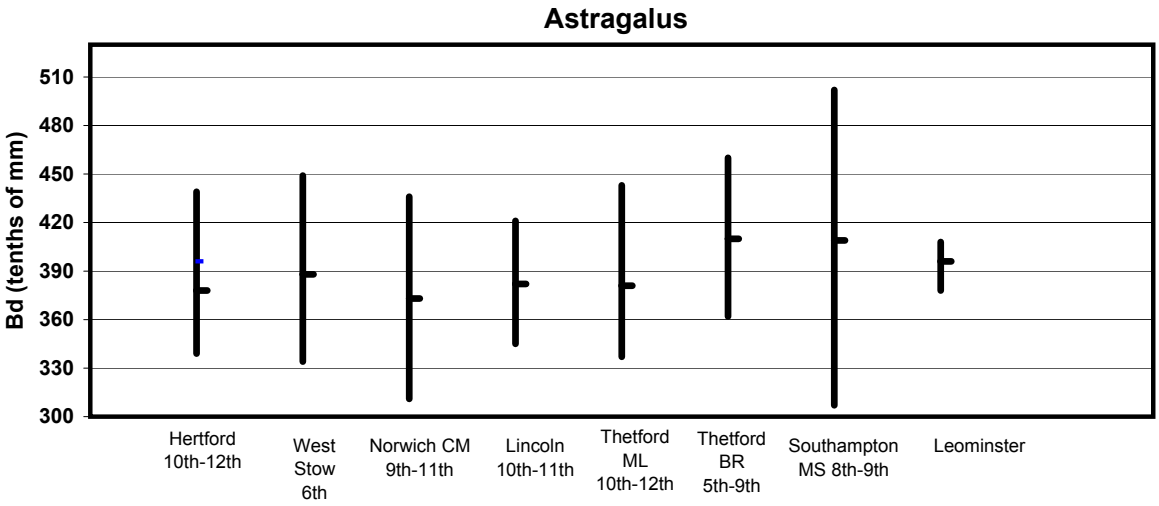
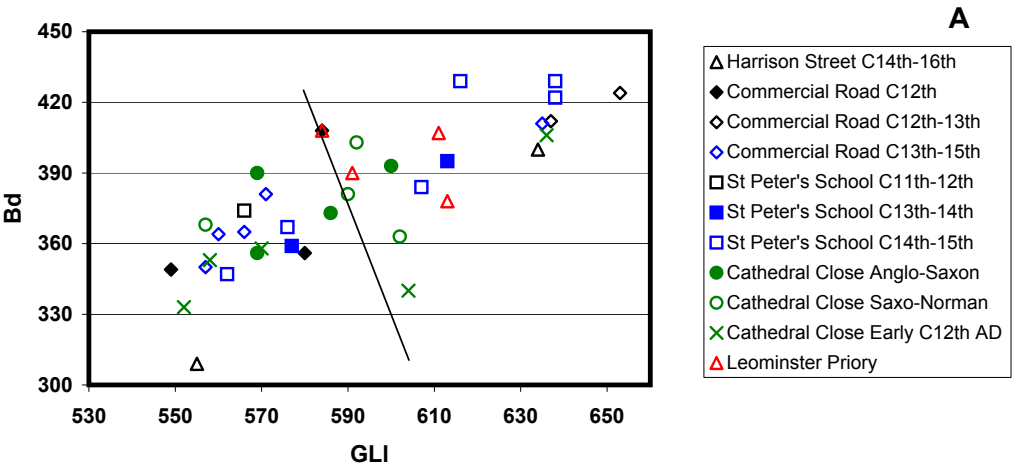
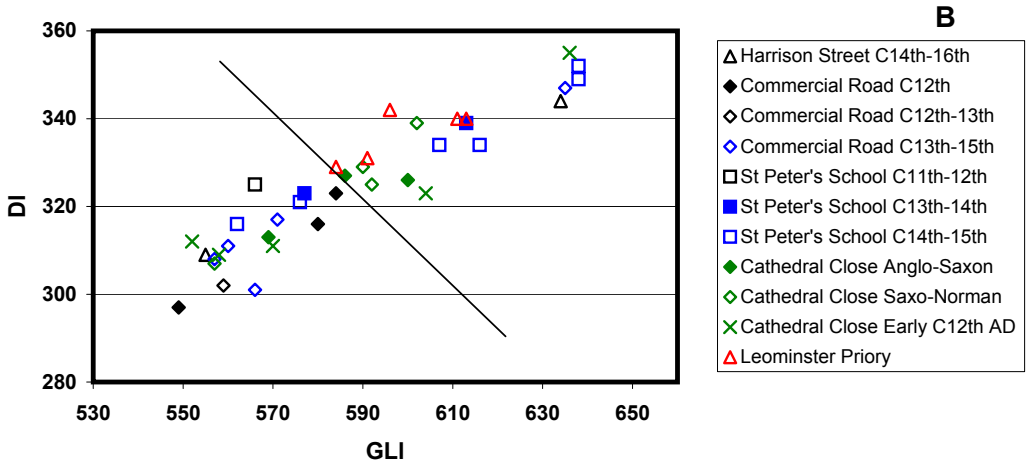


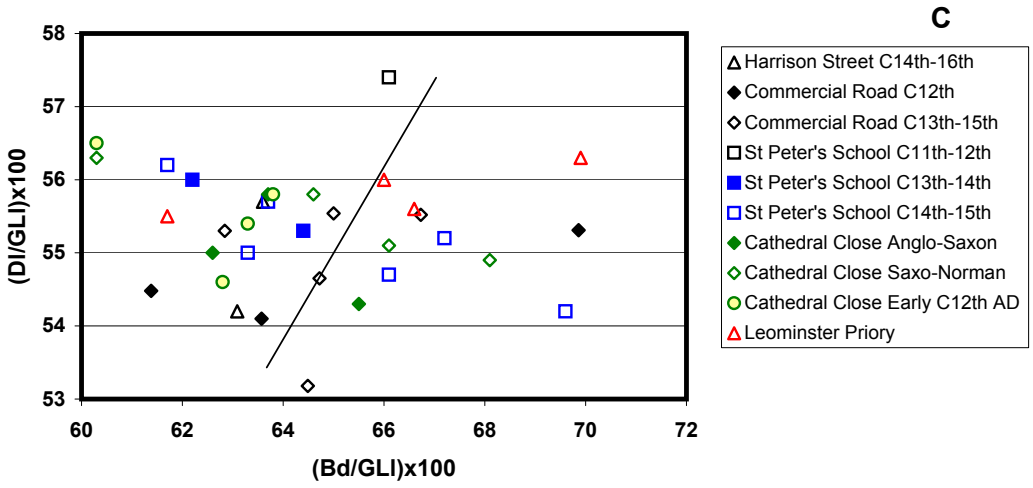
Figure 16 Size (A and B) and shape (C) of cattle astragali at Leominster Priory (Periods 3-4) compared with a selection of sites in Hereford

St Peter's School, 49-53 Commercial Road and 16-18 Harrison Street, Hereford based on Baxter (forthcoming a); Cathedral Close, Hereford based on Baxter (forthcoming b).

Measurements in tenths of mm.







Insert fig 4xxxx4 = Fig 16

Figure 16 Size (A and B) and shape (C) of cattle astragali at Leominster Priory (Periods 3-4) compared with a selection of sites in Hereford

The cattle remains derive from all parts of the skeleton and together with frequent cattle sized vertebra and rib fragments represent primary or secondary butchery waste. The cattle metatarsal from 74 and another from 72 have been longitudinally split, perhaps to access the marrow. A cattle rib fragment from 76 has multiple chop marks. No pathologies were observed on any of the Anglo-Saxon cattle bones.

	C	V	E	H	U	a	b	c	d	e	f	g	h	j	k	l	m	n	o	p
dP_4														1						
P_4											1	2								
M_1															2					
M_2																				
M_3																				
$M_{1/2}$												1		1	1					

Table 7 Period 3. Cattle wear stages of individual teeth (following Grant 1982). Both teeth in mandibles and isolated teeth are included. "a" includes unworn isolated teeth that could have been in one of the eruption stages (C,V,E,H,U)

	C	V	E	H	U	a	b	c	d	e	f	g	h	j	k	l	m	n	o
dP_4								1				1							
P_4																			
M_1							1												
M_2																			
M_3																			
$M_{1/2}$											1								

Table 8 Period 3. Sheep/Goat wear stages of individual teeth (following Grant 1982). Both teeth in mandibles and isolated teeth are included. "a" includes unworn isolated teeth that could have been in one of the eruption stages (C,V,E,H,U)

Sheep/Goat

Sheep/goat remains occur at the same frequency as those of domestic fowl (Table 6). In 14 out of 45 cases (31%) sheep can be positively identified. Nothing that could be identified as goat was seen in the caprid assemblage. No sheep horn-cores were present in the assemblage. Calcani and astragali recovered from (72) and (76) came from sheep of between 56-66cm (n = 4, mean = 60cm) high at the withers based on the multiplication factors of Teichert (1975), comparable to other sites in the same period Thetford and Southampton (Hamwic) for example (Baxter 2005 and Bourdillon and Coy 1980 respectively). Too few sheep/goat teeth were present in the assemblage to give any indication of an age profile (Table 8), but most epiphyseal ends of bones were fused suggesting that most of the sheep were skeletally adult (Table 10). The sheep remains derived from all parts of the skeleton and together with frequent sheep sized vertebra and rib fragments represent primary or secondary butchery waste. No pathologies were observed on any of the Anglo-Saxon sheep/goat bones.

Pig

As noted above, the bones and teeth of pigs comprised the most numerous species at Leominster in the Anglo-Saxon deposits. Pigs are known to form a significant dietary element on ecclesiastical sites and many religious establishments are recorded in the Domesday Book as owning large numbers of pigs and extensive areas of woodland set aside for pannage. The sexual composition of the pigs in the assemblage is broadly equivalent with ratios of 6 male upper canines or alveoli to 8 female and 4 male lower canines/alveoli to 6

female. This suggests that the pigs were being raised locally rather than imported as dressed carcasses. More intensive pig husbandry and/or the importation of live pigs or pig carcasses from further afield would result in a preponderance of males as exemplified, for example, by Tewkesbury Abbey (Baxter 2007). The pig mandibles and loose teeth from the Anglo-Saxon deposits primarily derive equally from subadults and adults, with most of the latter having M3 in an early stage of wear (Table 9). The epiphyseal ends of bones also indicate that most of the pigs belong to these age groups (Table 10). The pigs at Leominster are, therefore, equally divisible into porkers and baconers of both sexes. Even without any evidence of foetal or neonatal animals the likelihood is high that these pigs were produced locally. There are few measurable pig bones in the assemblage. A complete astragalus and Mt.IV from (72) are small when compared with specimens from Thetford (Baxter 2005) and the early monastic deposits at Tewkesbury Abbey (Baxter 2007). As with those of cattle and sheep/goat, the pig remains derive from all parts of the skeleton and together with frequent pig-sized vertebra and rib fragments represent primary or secondary butchery waste. No pathologies were observed on any of the Anglo-Saxon pig bones.

	C	V	E	H	U	a	b	c	d	e	f	g	h	j	k	l	m	n
dP_4																		
P_4							1			1		1						
M_1										1					1		1	
M_2							1			4								
M_3		1			1	1			1		1							
$M_{1/2}$																		

Table 9 Period 3. Pig wear stages of individual teeth (following Grant 1982). Both teeth in mandibles and isolated teeth are included. "a" includes unworn isolated teeth that could have been in one of the eruption stages (C, V, E, H, U)

Element	**Taxon**								
	Cattle			**Sheep/Goat**			**Pig**		
	n	**n_f**	**%**	**n**	**n_f**	**%**	**n**	**n_f**	**%**
Scapula	2	2		3	3		4	3	
Humerus dist	5	5		4	3		3	3	
Radius dist	1								
Ulna prox							1		
Metacarpal dist	1	1					4		
Pelvis acetabulum	3	3		3	3		2	2	
Femur dist							1		
Tibia dist	4	2		5	4		2	2	
Calcaneum	3	1		5	2		2		
Metatarsal dist	1	1					1	1	
Phalanx 1	6	5		1	1		5	4	
Phalanx 2	4	4							

Table 10 Period 3. Number and percentage of fused epiphyses for the main domestic mammals. Fused and fusing epiphyses are amalgamated. Only unfused diaphyses, not epiphyses, are counted. n = total number of fused/fusing epiphyses and unfused diaphyses; n_f = total number of fused/fusing epiphyses; % = percentage of fused/fusing epiphyses out of the total number of fused/fusing epiphyses and unfused diaphyses. Percentages for total number of epiphyses smaller than 10 have been omitted

Other domestic mammals

The other domestic mammals present in the Anglo-Saxon deposits were horse and cat. As noted above, horse bones and teeth are relatively frequent. A metacarpal (70) and a second metacarpal (72) came from horses of around 14½ hands high based on the multiplication

factors of May (1985). Jaws and teeth found range between 9 months to 1 year 3 months for a maxilla (74) with deciduous premolars and a slightly worn M1, to over 12 years old for exceptionally worn lower incisors (72). The average age at death for the horses was around 7 years (n = 7) based on incisor wear (Barone 1980) and the comparative wear curves of Levine (1982). A very slightly worn equid P4 (72) has a V-shaped internal sulcus, ptychostylid and a shallow external sulcus like a donkey (Plate 17a). This tooth was sectioned to reveal its adult morphology and the internal sulcus is seen to be much more U-shaped and like that of a horse or pony. There was a small adult cat proximal humerus (72). Other evidence for the former presence of cats comprises several bird bones with cat-sized tooth punctures (see below).

Figure 17a Young equid lower P4 with a V-shaped internal sulcus, ptychosylid, and shallow external sulcus (72, subgroup 9, Period 3)

Figure 17b Section through the same tooth as in Fig 11a revealing a more U-shaped internal sulcus

Wild mammals

The only wild mammal present in the Anglo-Saxon assemblage was roe deer (*Capreolus capreolus*). This species is represented by an isolated M2 (72) and a mandible (82; Fig 18).

Figure 18 Roe deer mandible (gully fill 82, subgroup 6, Period 3)

Birds (see also, S Hamilton-Dyer, this report)

As noted earlier, the remains of birds are particularly common in the Anglo-Saxon deposits. Domestic fowl alone comprises 13% of the total assemblage by number of identified specimens (NISP). None of the broken chicken bones seen contained deposits of medullary bone indicative of females in egg-laying condition (Driver 1982; Wing and Brown 1979). This is in contrast to Tewkesbury Abbey in the early monastic period where 16% of domestic fowl bones contained medullary bone (Baxter 2007). There was a chicken tibiotarsus (74) broken when young is short and deformed with a bowed shaft, the distal fibula fused to the shaft and a sub-circular hole with rounded margins in the condylus femoralis. The few fowl bones that could be sexed came from hens. Juvenile chicken bones were found in the assemblage suggesting that they were being raised in close proximity.

Goose bones were also relatively frequent. While most of these were greylag (*Anser anser*) size and probably derive from domestic birds, a tibia (72) is a closer match to pink-footed (*A. brachyrhynchus*) or white-fronted (*A. albifrons*). A goose ulna shaft fragment (76) has a healed break. Geese are well known for being belligerent and males will fight among themselves. The author has seen goose wing bones with healed breaks from a Roman site in Leicester (unpublished).

All of the duck bones are mallard-sized and could derive from domestic birds except for a teal ulna (72). Pigeon remains are relatively frequent, but all, except a femur (72), were wood pigeon size. A woodcock tibia (76) and a golden or grey plover humerus (84) were also noted.

Bird bones with butchery marks include a goose tibiotarsus (72) cut through the distal articulation and a chicken tibiotarsus with cut marks across the distal articulation (84). All of the bird bones found, irrespective of species, derive almost exclusively from the wing and lower leg, and so represent the parts discarded before culinary preparation. Bird bones with cat-sized tooth punctures were also found (84 and 76).

Discussion

In the Anglo-Saxon period most of the meat supplied to Leominster comprised beef although pig meat, both pork and bacon, was a significant dietary element. The sexual distribution of the pigs strongly suggests that they were being raised in the immediate vicinity rather than imported from further afield. Mutton formed a rather less important meat. Meat derived from birds, both wild and domestic, comprised a significant dietary supplement together with venison obtained from roe deer. It is thought that the common practice of keeping pigeons in dovecots attached to religious houses to supply meat dates from the medieval period when considerable numbers were consumed (Jones 1987), and it is significant that the majority of pigeon remains found at Leominster are comparable to the wild wood pigeon. It has also been assumed that while most of the geese found on Anglo-Saxon sites (eg Hamwic, Hants) are probably domestic, although indistinguishable skeletally from the wild greylag, the ducks are most probably wild. It is not until later that domestic ducks can be readily distinguished from wild mallards on the basis of size (Sheila Hamilton-Dyer, pers. comm). Isolated finds of certainly wild species suitable as food, such as sub-greylag size geese, teal, woodcock and plover, lend support to the suggestion that a significant proportion of the birds were supplied by wildfowling. The relatively high frequency of horse bones and teeth, including those of fairly young animals, suggests that these animals were important for transport as both mounts and pack horses, and may have been bred locally.

Period 4 Medieval (Subgroups 11, 12, 13, 14, 15, 16, 17, 18, 19, 21)

The exceptionally small medieval assemblage provides some evidence for the continuing importance of pig meat and the occasional consumption of venison obtained from roe deer, and wildfowling (represented by single fragments).

Period 5 Dissolution (Subgroups 10, 17, 20, 22, 23, 24, 25, 26, 27)

Because the material from Period 5 covered such a wide date range, only the number of fragments per taxon, measurements of complete bones and other elements of particular interest were recorded. The assemblage was dominated by cattle fragments comprising almost 54% of the total. Sheep/goat was next numerous at 18% and pig at 16%. The only caprid remains that could be identified to species belong to sheep (12 out of 35) (Table 6). Complete cattle limb bones from which a withers height could be calculated using the factors of Matolcsi (1970) range between 112cm to 116cm (n = 3); and the sheep from 56cm to 65cm (n = 4) based on the factors of Teichert (1975). The lower M1 and M2 of a large dog were found (24) and an equid upper deciduous 2nd incisor from an animal aged around 15 months (69). A cattle 1st phalanx from the forefoot (45) has exostoses (Stage 4) near the proximal end (Fig 19). These are commonly found in draught cattle (Bartosiewicz *et al* 1997).

In contrast to the pigeon remains found in the Anglo-Saxon deposits, the only pigeon remains found in Period 5 were comparable to domestic birds. They included an uncounted distal ulna full of medullary bone (51) indicative of a bird in egg-laying condition (Driver 1982; Wing and Brown 1979). A passerine humerus (69), similar in size to brambling, yellowhammer or wagtail, was most probably an accidental inclusion. Hand-recovered fish bones included two bones of ling from fish of over 1m (40), and indeterminate fragments from a large fish (47).

Figure 19 Cattle 1st phalanx from forefoot with exostoses (Stage 4) near proximal end (45 subgroup 22, Period 5)

4.2 Small bone (*by* S Hamilton-Dyer)

Introduction and methodology

A total of 40 litres was sieved of Sample 1 from fill 84 and 27 litres of Sample 3 from the lower fill 86. In addition to animal bones, cess/coprolite was noted (not examined by the author) and an iron fish-hook from context 84 (see above). Taxonomic identifications were made using the author's modern comparative collections. All material was recorded; all fragments were identified to species and element where reasonably possible. The archive includes details of metrical and other data not presented in the text.

Results

Well over 1300 specimens were recorded from the two samples; 759 from 84 and 639 from the lower fill, 86. At least 18 taxa are present and include large mammals, small mammals, birds, reptile, amphibia and fish (Table 11).

ducks	wader	pigeon	passerine	indet. bird	reptile	amphib.	salmo	grayling	eel	herring	indet. fish	totals
1	1	-	5	28	-	8	18	2	125	19	69	759
3	-	1	2	22	1	2	34	-	154	26	93	639
4	1	1	7	50	1	10	52	2	279	45	162	1398
0.3	0.1	0.1	0.5	3.6	0.1	0.7	3.7	0.1	20.0	3.2	11.6	

Table 11 Leominster small bone species list

A large proportion of the remains are very small fragments of mammal bone. These are almost certainly pieces from larger mammals such as cattle, sheep and pig. All three of these taxa were represented in fill 84, while cattle was absent from fill 86. The three cattle bones from 84 were a 3rd phalanx, a fragment of ulna and the distal part of a butchered humerus. The 17 sheep bones from both fills were a mixture of loose teeth and parts of limb bones, mainly from the foreleg. Most of these bones had late-stage epiphyses unfused (ie the sheep were probably under three years at death). The pig bones were mainly of sub-adult mandible, loose teeth and foot bones. In fill 86 there was also the partly charred scapula of a perinatal piglet. Other large mammal bones included pieces of rib and limb shaft, some very well preserved and some with evidence of dog gnawing. Several of the very small indeterminate fragments had the appearance typical of dog digestion. Smaller mammals included remains of a shrew, a woodmouse and three field voles in fill 84 and several indeterminate but similarly sized remains from fill 86. A reptile vertebra from fill 86 was probably that of a slowworm. A few amphibian bones were also present, and included frog.

Bird bones were frequent, domestic fowl being the most common of the identified bones, followed by small passerines. These were of two sizes, comparable with blackbird and sparrow but could not be positively identified. Goose and duck number four bones each. The duck bones include one comparable with teal and three of mallard/domestic. A single wader bone (84) was woodcock, while a single pigeon bone (86) was comparable with woodpigeon.

Fish bones were frequent in both pit fills, 233 from fill 84 and 307 from fill 86. Just four species are present; eel, herring, salmon and grayling. Eel is numerically the most frequent at 279 specimens. Most of these represent eels that are neither elvers and young eels but not large sized either, probably around 30-40cm. A few vertebrae in both fills represent full sized eels of 50cm or more. Some of the bones are crushed, probably indicating human ingestion (Jones 1986). Salmonid bones are the next most frequent at 52 specimens. These include some vertebrae and head bones of small and medium fish, probably salmon parr and smolts (rather than trout), while a few vertebrae are of large salmon. It is tempting to suggest that the fish-hook found was associated with catching salmon, as nets and traps are more appropriate for catching eels. Some of the small salmonid vertebrae are also crushed, as is one of the 45 herring bones. The remaining two specimens that could be identified to species are two scales of grayling. This relative of salmon is not commonly identified in archaeological assemblages, and frequently only from the robust and distinctive scales. The majority of the major bones of this species are sufficiently distinct as not to be confused with those of salmon.

The value of sieved samples for faunal analysis is both as a check on the hand recovered material (as small elements of the larger mammals and very young material is often missed by hand collection) and, especially, for recovery of the smaller fauna. The small mammals and amphibian remains are common finds in pits. Some may be swept in with other rubbish while others are probably pit-fall victims. Apart from a handful of large bones from post-medieval contexts, and a few indeterminate fin rays from 67, 76 and the two pit fills that were sieved, no fish remains were recovered by hand.

The grayling is restricted to freshwater, preferring clean rivers. Salmon and eel are migratory but it seems likely that these also came from one of the local rivers. Herring, however, is an obligate marine species and must have been bought in. The most likely trade route is from Gloucester via Hereford. Medieval deposits in Hereford were dominated by herring and eel but also contain a wide variety of other, mainly marine, fish (Hamilton-Dyer 2002). This is typical of most other medieval sites, even those well inland. Several marine fish including cod and haddock have been previously identified in a medieval deposit from the priory (Locker 1994). Throughout the post-conquest period in England, herring and Gadidae were common with the large Gadidae becoming increasingly important (Locker 2000). In contrast, most Saxon deposits have relatively low levels of Gadidae and only those sites with easy access to the sea have a wide variety of species (eg Southampton; Coy 1996). Similarly at Deansway in Worcester, fish, especially marine species, are scarce in the late Saxon deposits. As at Leominster, they are dominated by eel and herring, a few salmonids and cyprinids also being present. Fish, especially marine species, are not frequent until the medieval period (Nicholson and Scott 2004). The sharp increase in the amount of marine fish in assemblages from the end of the first millennium is Europe-wide (Barrett *et al* 2007), earlier exploitation appearing to have been of low intensity. The presence of a relatively large quantity of marine fish, albeit of one species, at this inland site in the pre-medieval period perhaps indicates a certain level of status.

Note. Species list and abbreviations used in text, tables and archive:

COW, domestic cattle, *Bos Taurus;* SHE, domestic sheep, *Ovis aries*; S/G sheep, *Ovis aries* and/or goat, *Capra hircus;* PIG, domestic pig, *Sus domesticus*; LAR, large ungulate size (probably mostly cattle but may also include some horse); SAR, small ungulate size (probably mostly S/G and PIG); MAM, unidentified bone, probably mostly SAR and/or LAR;

APO SPP, woodmouse, *Apodemus* sp*;* MIC AGR, fieldvole, *Microtus agrestis*; SHREW, shrew, *Sorex* sp; SMM, small mammal, indeterminate;

FOW, domestic fowl, *Gallus gallus*; GOO, domestic goose or greylag, *Anser* anser; ANA P/D, domestic duck or mallard, *Anas platyrhynchos*; ANA SPP, other duck, cf. teal, *Anas crecca*; WADER, wader cf. woodcock, *Scolopax rusticola*; COL FAM, pigeon, cf woodpigeon, *Columba palumbus*; PASSER, small passerines, songbirds; BIR, bird bone fragments, probably mostly fowl;

REPT, indeterminate reptile; AMPH, amphibian, includes common frog, *Rana temporaria*;

EEL, eel, *Anguilla anguilla*; CLU HAR, herring, *Clupea harengus*; THY THY, grayling, *Thymallus thymallus*; SALMO, salmon, *Salmo salar*, or trout, *Salmo trutta*; FIS, fish bones not identified to family or species.

4.3 Shell (*by* D Hurst)

There was a small amount of oyster shell from two Period 5 deposits (40, 47).

4.4 Palaeobotanical report (*by* E Pearson)

A total of two samples of middle Saxon date (*c* AD 650-730) were selected for analysis from the following contexts:

- Context 84 (sub-group 7) – fill of pit 85, rich in domestic rubbish and animal bone;

- Context 86 (sub-group 7) – lower fill of pit 85, rich in domestic rubbish and animal bone; and associated with a radiocarbon date (UB 6670; BP 1351 +/- 32; Cal AD 650-730 at 85% probability).

Lower fill of pit 85 (context 86)

Only one charred grain of free-threshing wheat (*Triticum* sp free-threshing) was recovered in association with moderately abundant large mammal, small mammal, amphibian, reptile, fish and bird bones (see above). Occasional fragments of phosphate concretion and hammer-scale flakes were also noted.

Secondary fill of pit 85(context 84):

A single pea (*Pisum sativum*) and single grains of free-threshing wheat (*Triticum* sp free-threshing) and oat (*Avena* sp) were recorded in association with occasional fragments of phosphate concretion, abundant large mammal, small mammal, fish and bird bone (see above). An iron fish-hook and a small amount of fired clay were also found during the sample processing.

Discussion

As the charred plant remains were particularly sparse and associated with much larger quantities of mammal, bird and fish bone, this material is more likely to be kitchen rather than agricultural processing waste. It is likely to have been accidentally charred during parching prior to cooking (for example before adding to pottage) or before storage. Pea and free-threshing wheat are likely finds for samples of this date being common crops in cultivation. Little interpretation, however, could be made of arable crop husbandry and processing methods on account of the small size of the assemblage recovered. Phosphate concretions would normally be associated with cess waste because of the high levels of calcium phosphate in this material. However, in this case, it is more likely to have resulted from the abundance of animal bone, particularly as no fruit pips and seeds (often found in cess waste) were recorded.

During assessment context 82 from the same site period was observed to contain occasional charred cereal fragments (Cereal sp indet grain), barley grain (*Hordeum vulgare*) and a single charred fragment of hazel nut (*Corylus avellana*). These remains are likely to represent general background waste.

Overview of the environmental evidence

The assemblage from pit 85 is characteristic of waste associated with large well-organised (often monastic) estates of Saxon or medieval date. The abundance of fish and bird bone, the diversity of animal resources used, and the importance of pig suggest high status sites. In particular, pig rearing in extensive areas of woodland and fish rearing in fish-ponds are activities often associated with monastic estates (see above).

There are only a few local sites from which environmental remains of Anglo-Saxon date have been recovered. These include, for example, urban sites at Upwich in Droitwich (Meddens 1997), Deansway in Worcester (Nicholson and Scott 2004), Cathedral Close in Hereford (Hurst *et al* 2003) and one rural site at Aston Mill Farm, Kemerton in Worcestershire (Lovett 1990). The animal bone reported here does not compare well with these small and broadly contemporary assemblages of general domestic waste from other west Midlands sites, but compares better with assemblages from later, monastic sites of medieval date, for example at Hereford Cathedral Close (*op cit*), Shrewsbury Abbey (Jones, A K G, 2002; Jones, G G, 2002) and from previous excavations at Leominster Old Priory (Locker 1994). There is also some similarity with Hereford assemblages of medieval date from urban and ecclesiastical sites (Noddle 1985; Bramwell 1985; Jones and Spencer 1985; Noddle 2002; Noddle and Hamilton-Dyer 2002; and Hamilton-Dyer 2002), the ecclesiastical sites including within the precincts of the Cathedral, the Bishop's Palace, and St Guthlac's Priory. The association of

fish bone with monastic sites may partly be a result of the observance of the religious customs relating to the abstinence of eating meat on certain days of the year (and the substitution with fish and other foods). This may also be the explanation for the wider incidence of this type of food waste in more urban settings, where similar observance was practiced by the wider urban population. This could, therefore, reflect the piety of the monks and the town-dwellers within their purview, or, alternatively, it may be that fish were more available in market towns through trade, whereas the monks usually had their own supplies.

5. The archive

All retained material (the site archive) will be boxed, bagged labelled etc in accordance with Herefordshire Museum Service guidance.

The artefactual archive comprises of:

43	context finds summary sheets
29	pottery record sheets
1	radiograph of select iron objects
1	box of pottery
1	box of ceramic building materials (except medieval floor tiles)
6+	boxes of medieval floor tile
1	box of metalwork and miscellaneous small finds
7	boxes of building stone

The environmental archive consists of:

8	boxes of animal bone
1	CD with animal bone database
3	Sample record sheets AS17
3	Flot record sheets AS21
3	Bags of residues of flots.

6. Acknowledgements

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Appendix

Characterisation studies of a floor tile from Leominster Priory, Herefordshire (*by* Alan Vince)

A single sample of medieval glazed floor tile from the 2005 Leominster Priory evaluation was submitted for characterisation. The sample is apparently typical of the fabric of the medieval tile from the site and was studied using thin section and chemical analysis. These studies suggest that the tile is a Bredon-type tile (Vince and Wilmott 1991) for which a source in Hereford has been suggested.

Thin-section analysis

A thin section was produced by Steve Caldwell, University of Manchester (Sample Number V3366). The section has been added to the AVAC reference collection. The fabric is fine-textured, with very few inclusions over 0.1mm across, and the tile has a reduced, light grey, firing, with oxidized base and sides. The lack of oxidation on the upper surface is due to the presence of a lead glaze and indicates that the tile was fired once only, with the glaze present.

The following inclusion types were noted:

- Subangular and angular quartz. Abundant, ill-sorted grains ranging from less than 0.1mm across to c.0.5mm across, but mostly less than 0.2mm. The grains are mostly monocrystalline and unstrained but polycrystalline, strained grains were also present.

- Feldspar. Sparse subangular fragments of plagioclase and microcline feldspar up to 0.4mm across.

- Siltstone. Sparse angular siltstone fragments up to 1.0mm across. The majority of the grains are angular quartz with minor laths of feldspar and amorphous brown inclusions and cement.

- Mudstone. Spare well-rounded dark brown grains up to 1.0mm across.

- Limestone. Moderate rounded marl fragments up to 1.0mm across. These are composed of non-ferroan calcite.

The groundmass is optically isotropic.

Chemical analysis

Chemical analysis was carried out at Royal Holloway College, London, under the supervision of Dr J N Walsh using Inductively-Coupled Plasma Spectroscopy (ICP-AES). A range of major and minor elements were measured (Appendices 1-2). The major elements were measured as percent oxides and the minor elements as parts per million.

Silica was not measured but was estimated by subtracting the total major element count from 100%. The estimated silica content is 68.7%.

The ICPS data were then normalised to Aluminium and compared with data from two groups of floor tiles from Abbey Dore (Vince 1997), one of which (Fabric 1) was thought to be made nearby whilst the other was thought to be an early group of Bredon-type tiles. Factor analysis was carried out on this dataset and three significant factors were found. Because Abbey Dore Fabric 1 contains a much higher limestone content than the Bredon-type tiles, calcium and strontium were omitted from the analysis. Figure 1 shows a bi-plot of the first two factors and shows that the Leominster sample falls within the Abbey Dore Fabric 2 group.

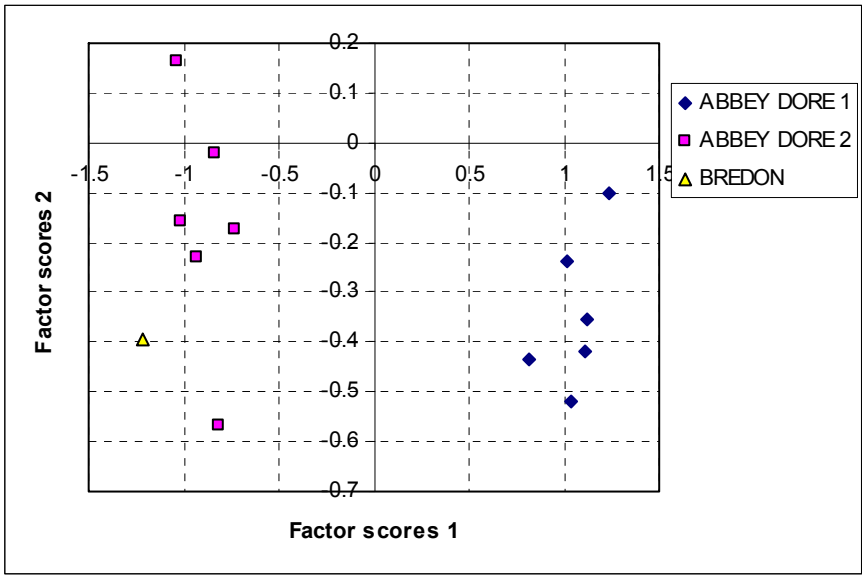

Figure 1

Figure 3 shows a bi-plot of Factor 1 versus Factor 3. This shows that the Leominster sample can be distinguished from the Fabric 2 samples by its Factor 3 score. The principal differences between the two groups appear to be the Lithium and Sodium contents. The latter is probably due to differences in feldspar content between the samples.

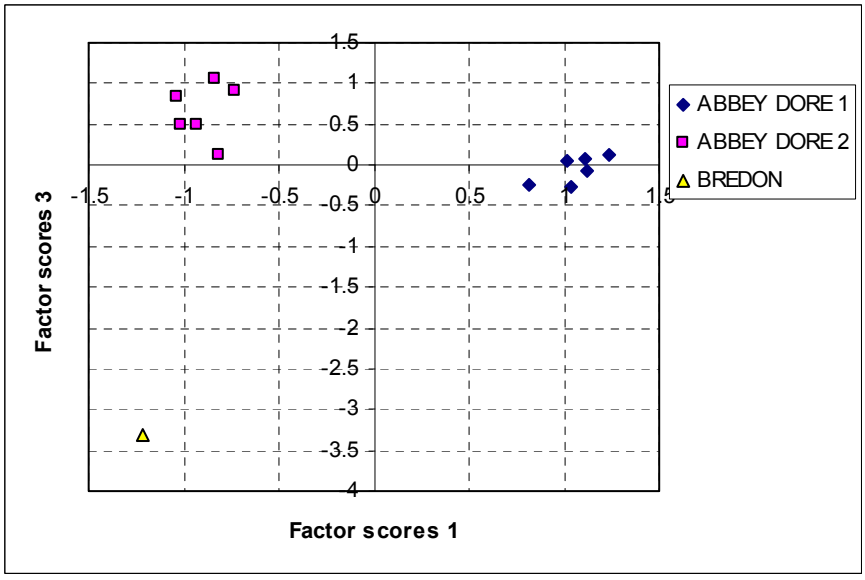

Figure 2

Appendix 1 (sample ref TSNO V3366)

Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO
16.94	6.19	2.43	0.99	0.85	2.8	0.79	0.16	0.065

Appendix 2 (sample ref TSNO V3366)

Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
463	92	27	39	56	16	77	104	15	49	36	65	37	5	1	3	2	121	80	18

Discussion

Thin-section and chemical analysis indicate that the Leominster sample is probably a Bredon-type tile, produced in the Hereford area. Such tiles survive in the priory church at Leominster and some of those tiles were decorated with dies which occur on tiles found in Hereford (Vince 1985). When compared with samples of a group of Bredon-type tiles from Abbey Dore it is possible to distinguish the Leominster and Abbey Dore groups and this suggests that the two groups of tile were produced as separate batches.

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