MEDIEVAL TILE INDUSTRY AT PENN

MILES GREEN

From the 1350s to the 1380s, Penn had the most extensive, successful and well-organised tile workshops in England with close to a monopoly on the supply of vast quantities of decorated floor tiles and roof tiles, for royal palaces and major ecclesiastical and secular buildings all over London and the south-east of England. This study is the first attempt to bring together all that has been discovered during the last century, both nationally and locally, about the Penn tile industry. It covers distribution, transport, tile design and floor layout, as well as the method of manufacture and operation of the kilns. Appendix 1 provides a chronological local gazetteer of the many tile finds in Penn. All this information is set in its historical context and significant new explanations are offered as to why this particular modest rural parish should have been able to achieve such a remarkable dominance of the market for two or three generations.

INTRODUCTION

The best-known tilers in England

Penn had the most extensive, successful and well-organized commercial tile workshops in medieval England. For over forty years of the fourteenth century, between the 1350s and 1380s, Penn tilers secured something close to a monopoly in the South-East and were manufacturing vast quantities of floor and roof tiles for royal palaces, monasteries and churches, manor houses and rich merchants' houses, in London and the surrounding counties. The distances involved and the constant mention of Penn and Penn tilers by name, suggest that they had surpassed any rivals in both workmanship and price.

This study is a local historian's attempt to bring together all that has been discovered about Penn tiles, both nationally and locally, and to set the Penn tilers in their historical context. This approach has revealed a number of new factors that help to explain the mystery of why Penn was so successful and for so long.

The name Tylers Green still reminds us of the local importance of the tilers. Tyler End, as a hamlet of Penn, is recorded in a 1493 property deed.[1] It replaced an earlier name of Garrett Green or Gerrards Green, presumably in the fourteenth century.[2] The name Tyler End Green was used for the next four hundred years until the 'End' started to drop out of use during the eighteenth century. The 1841 census still had Tylers End Green, but it was Tylers Green, Penn by the 1851 census, As a hamlet grew up on the Wycombe side of the parish boundary, it borrowed the name of Tyler End Green from Penn and has now become Tylers Green. Clay Street and Potters Cross are two more place names in the parish associated with working clay. Fig. 1 is a sketch map of Penn & Tylers Green showing where tiles have been found, the claypits and the ponds.

We know far more than usual about the workings of the fourteenth-century Penn tileries because there are so many well documented royal orders for the tiles and because identifiable Penn tiles have been found in hundreds of different locations. A good deal of research has been done over the last seventy years, the main contributors being:

- **W. H. St John Hope,** whose comprehensive two volumes, *Windsor Castle. An architectural history*, published in 1913, include most of the references in the Exchequer accounts and in contemporary Pipe Rolls to the purchase and laying of Penn tiles for Windsor Castle.
- **L. F. Salzman,** who wrote *English industries of the Middle Ages* in 1923. He made only one passing reference to Penn, as the chief supplier of tiles for Windsor Castle, but gives useful background on medieval tilers generally and valuable details for the output and costs of

[1] BRO AR/136/79/1B A grant by John Kane confirming his wife's right to continue to live in their house at tyler end after his death
[2] John Chenevix Trench and Miles Green, 'Wycombe Heath and its Charter' *Records of Buckinghamshire*, **36** (1994), p. 44, 152. The 'End' is because it was one of the ends of a 4000 acre Wycombe Heath surrounded by the hamlets of Tyler End, Widmer End, Heath End, Spurlands End, Beamond End and Mop End

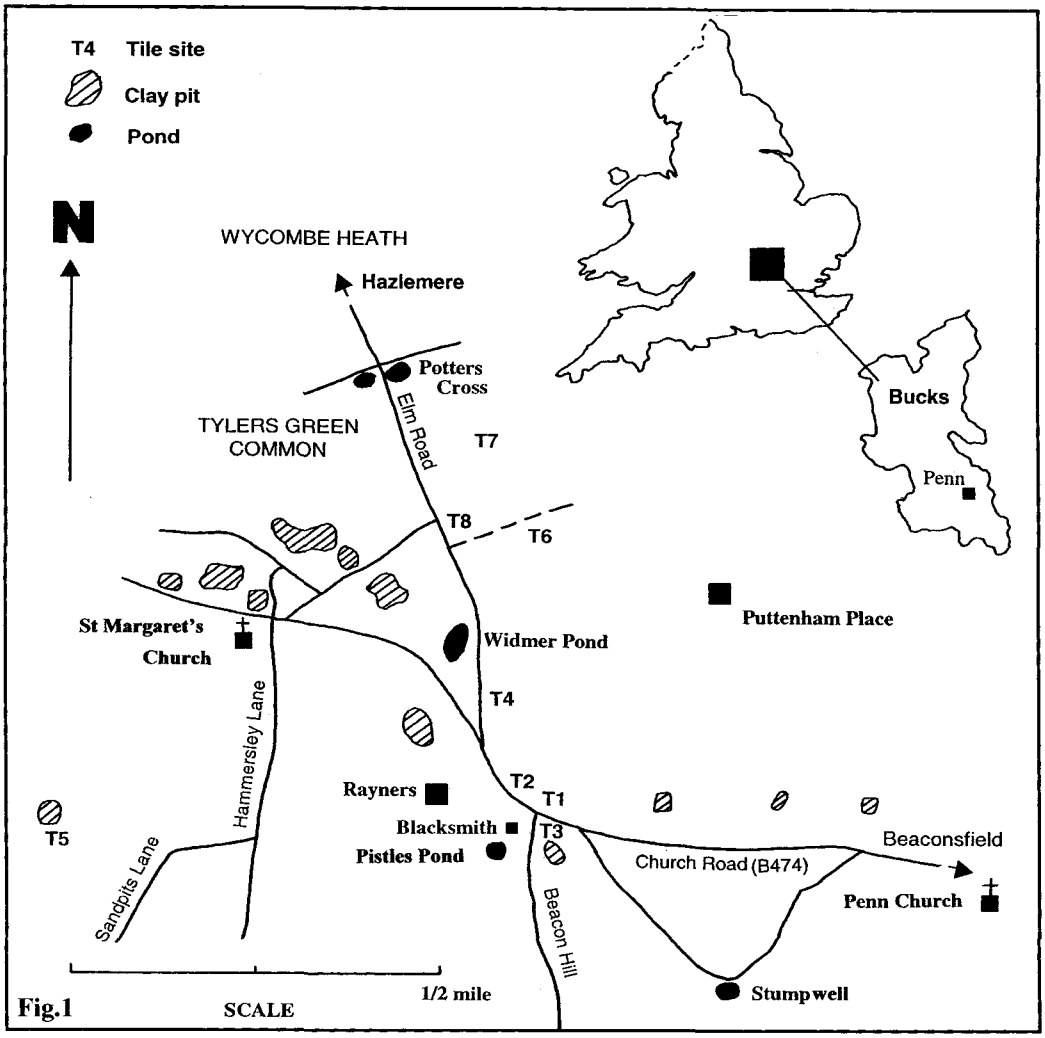

FIGURE 1 Map of Penn and Tylers Green. *Drawn by Melanie Steiner.*

another large roof tileworks at Wye in Kent that was operating at the same time as Penn.[3]

- **Gilbert Jenkins,** who was the first to find and publish, in 1935, two important documentary references to the Penn tile industry that are discussed below – the 1332 tax return and the 1350 summons for tilers and tiles for work in Westminster Palace and the Tower of London. But he was still able to deal with the Penn tile industry in a single paragraph.[4]
- **Loyd Haberly,** who published *Medieval English Pavingtiles* in 1937. He focussed on illustrating all the tiles he could find relating to 260 churches and chapels within a fifteen mile radius of Oxford. He divided them into two main groups, the second of which he called 'Later tiles printed

[3] L. F. Salzman, *English industries of the Middle Ages,* Clarendon Press, Oxford (1923), pp. 173–83
[4] J. Gilbert Jenkins, *A history of the parish of Penn* , The Saint Catherine Press, London (1935), pp. 55–6

and unkeyed', some of which were later identified by Christopher Hohler as made in Penn. Haberly was not particularly interested in where the tiles had been made and took only five lines to deal with 'a great tile factory at Penn which supplied ...Windsor Castle in the mid fourteenth century'. He did however, have a good understanding of the practicalities of medieval tile-making, having built his own kiln and experimented with different techniques.[5]

- **Christopher Hohler,** who had shared some investigations with Haberly, opened up the subject with his thorough field-work and two comprehensive *Records* articles, in 1941 and 1942, on medieval paving tiles in Buckinghamshire. One of his stated purposes was to bring out the importance of the tileworks at Penn and he drew and numbered 173 tiles which he had attributed firmly to Penn (in a series beginning with P), noting all the places where they had been found, and thus laid the foundations for their accurate recognition.[6] It is his drawings that have been used throughout this article, including for the computer representations of floors.
- **Elizabeth Eames**, Curator of the Department of Medieval and Later Antiquities of the British Museum, who added a good many new designs as well as further contemporary references to Penn tiles in the public record. Her comprehensive two volume *Catalogue* has numbered drawings of all the tiles in the Museum's collection, of which Penn tiles are a significant part. Her design number is preceded by E. She also reviewed all that was known about the design and manufacture of medieval lead-glazed floor tiles.[7]
- **Ian Betts,** of the Museum of London Specialist Services, who has listed all the Penn tiles found in medieval churches in London.[8] He has also recently completed an assessment report recording the discovery of finds resulting from stabilising work on the Round Tower in Windsor Castle and excavations following the great fire of 1992.[9]
- **Laurence Keen,** who in a recent paper, *Windsor Castle and the Penn tile industry*, lists all published contemporary references to Penn tiles and tilers and adds some new ones found in the Exchequer accounts by Stephen Priestley. He describes and discusses, for the first time, the design of the *in situ* floor of the Aerary in St George's College and reviews the published descriptions of the floors in the Chapter-house at Windsor, the Tower of London and Whitehall Palace. This enables him to demonstrate how an attractive pavement was made from comparatively cheap and easily laid tiles, an important ingredient in their success. He has also produced an up-to-date gazetteer of all sites where Penn tiles have been found, and a map showing their distribution in the South East.[10]
- **Clive Rouse**, **John Broadbent, Michael Farley** (former Buckinghamshire County Archaeologist), and **Stanley and Pauline Cauvain**, have been the main contributors to the growing body of knowledge that has come from reports, in *Records of Buckinghamshire,* on the finds in Penn and Tylers Green since the Second World War. The Local Gazetteer at Appendix 1 summarises all their discoveries. Stanley Cauvain has combined chemical and statistical analysis of medieval ceramics to demonstrate 'chemical fingerprints' that distinguish between four production centres, including Penn, in south Buckinghamshire.

  His attempt to match ceramic and clay profiles from five sites within Penn itself revealed some potential.[11]

[5] Loyd Haberly, *Medieval English Pavingtiles,* Blackwell, Oxford (1937), pp. 50-63, 137–297

[6] Christopher Hohler, 'Medieval paving tiles in Buckinghamshire', *Records of Buckinghamshire,* **14** (1941), pp. 1–49, and 14 (1942), pp. 99–132

[7] Elizabeth Eames, *Catalogue of Medieval lead-glazed earthenware tiles in the British Museum* (1980), Vols 1(text) & 2 (Drawings). The Hohler classification is more relevant to Penn tiles and so has been used in this study in preference to Eames where there is a choice. New designs found since 1980 are neither in Hohler nor Eames.

[8] Ian Betts, 'Appendix: Medieval floor tiles in London churches', in John Schofield, 'Saxon and medieval parish churches in the City of London: A review', *TLMAS.,* 45 (1994), pp. 133–40

[9] Ian Betts, *Windsor Castle. Assessment Report on decorated and plain floor tile,* Museum of London Specialist Services (1998)

[10] Laurence Keen, 'Windsor Castle and the Penn tile industry', *Windsor. Medieval Archaeology, Art and Architecture of the Thames Valley* (2000), reprinted in the *British Archaeological Association Conference Transactions,* XXV (2002), pp. 219–37

[11] Stanley Cauvain, 'Chemical analysis of medieval ceramics from South Buckinghamshire', *Chiltern Archaeology, recent work. A handbook for the next decade,* Robin Holgate (Ed), (1995), pp. 145–152

The early Penn tilers

The earliest recorded tiler in Penn was Nicholas the tiler *(tegulator)*, who held a property from Stephen de Segrave in 1222.[12] We do not know whether he was making floor tiles or roof tiles or both. He was a freeholder. A villein would have had neither the time nor the freedom to embark on anything not directly in the interests of his lord. Most of the Segrave Manor land was in Knotty Green towards the Beaconsfield border and this could explain the road name 'Clay Street' in that part of the parish, where two deep pits, which may have been the source of Nicholas's clay, still survive. No doubt there were tilers before him but we have no record of them. We know that, by the mid-twelfth century, roof tiles were being made in England and that glazed floor tiles were laid in St Alban's Abbey in c. 1165 and in Winchester before 1093[13]. Two colour tiles, i.e., those using white clay slip to create a decorative effect, were in use by the 1240s.[14]

The earliest surviving tax record for Penn, is the return for the Subsidy Roll of 1332.[15] It reveals the Penn tile industry already in full swing and shows Simon the paver as the richest man in the parish after John de la Penne, lord of the manor of Penn. John the tiler and Henry Tyler were also among the ten most prosperous members of the parish. The three of them together were assessed at 6s 4¼d, almost equalling the lord of the manor and his mother (holding a widow's dowry of one third of the manor), who together paid 6s 10¼d.

Their names suggest that John and Henry made the tiles whereas Simon the paver laid them, but there was no such clear-cut division and neither surnames nor spellings had yet settled. The same word could be used for the man who made the tiles, laid them on a floor or hung them on a roof. Simon and John each had a stock of 4,000 floor tiles while Henry, the least prosperous of the three, held a stock of 7,000 roof tiles. All carried stocks of lime (to mix with sand to make mortar). They were also all small farmers, each with a cow. The two more prosperous pavers also had a horse and two pigs each.

Later fourteenth century documents identify seven other men as 'tilers of La Penne'. Four are contemporary – Walter Baldewyne (c. 1348), William Tylere (c. 1349), Robert Jonesone (c. 1350) and Robert Tillare (1353).[16] In addition, John Paviere was a neighbour of the Vicar of Penn who was murdered in 1368[17], John Tylere was disputing the ownership of some land in Chalfont St Peter in c. 1388[18] and Thomas Pavyere was a juror in 1389.[19] Roof tile production continued in Penn after this date, but no further record survives of decorated floor tiling.

Penn Tiles At Windsor Castle

Penn tilers were the beneficiaries of crucial royal patronage from Edward III (1327–77), and to a lesser extent from Richard II (1377–99). Both monarchs are portrayed in Penn Church on corbels supporting the roof of Penn Church which was put up early in c. 1400. They include, what are judged to be a kingly portraiture of Edward III, for whose patronage the parishioners had every reason to be grateful (Fig. 2b), and a caricature of Richard II (Fig. 2c) as a demonstration of Penn's loyalty to Henry V, their overlord, who had deposed Richard II in 1399.[20] Penn floor and roof tiles were used extensively in royal palaces, particularly in Windsor Castle where Penn tilers were kept hard at work for over eight years.

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[13] L. Keen, 'Pre-conquest glazed relief tiles from All Saints Church, York' *JBAA* **146** (1993) 67–86.

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[17] J. Gilbert Jenkins, *op. cit*., p. 64

[18] CP 40/507/624d

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In 1344, 40,000 tiles were ordered from Penn, 'for the covering of the walls of the house of the Round Table and for the covering of stones in the same place'. This appears to suggest that the walls as well as the floors were to be decorated with the Penn tiles, but the price of 2s per thousand suggests that they were all plain roof tiles, and this is confirmed by the entry in the Pipe Roll that includes the laths, pegs and nails.[22]

Decorated floor tiles

There are no more recorded royal orders until after the first appearance of the Black Death in 1348. The first order for decorated Penn floor tiles for Westminster Palace and the Tower was placed in 1350 and for Windsor Castle in 1351. Over the next twelve years, the Castle's accounts and Pipe Rolls show that Penn supplied the bulk of both roof and paving tiles for the principal rooms. All available information on Penn floor tiles, provided for Windsor Castle between 1351 and 1363, is set out in Table 1.[23]

The changing cost of tiles is best seen from column 4 of Table 1. The price was highest immediately after the Black Death, at 8s per 1,000, but only for the first order. It had dropped by 25% within six months, by nearly 50% two or three years later and by fully 50% after 10 years. This suggests strong competition. The value of floor tiles shown on the 1332 tax return was only 2s per 1000. This may have been the cost of manufacture, but a valuation for tax purposes is likely to have been understated. On the other hand, the limited evidence for carriage costs for 1352 and 1354 is that they went up by 25% in two years from 6d to 8d per 1,000. The 1355 carriage costs cannot be identified because the Pipe Roll entries include roof tiles.[24]

There were two distinct phases of provision. Between 1352 and 1357, 97,500 tiles were laid steadily. There was then a gap of five years until 1362–3 when 152,500 more tiles were laid during a very intensive two years.

1,000 of the 4½ inch square tiles occupy a floor area of 140 sq ft. In other words a modest sized room of say 14ft x 10ft. The grand total of 250,000 tiles laid at Windsor would have paved 250 such rooms or a strip of 0.8 acres, 100 yds long and 39 yds wide.

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Table 2 sets out all the available information on payment to tilers working at Windsor Castle between 1352 and 1365.[25] Elie the paver ('Elie Tilere pavier in 1352 and 'Elie paviere' in 1365, but never 'Elias' in the original Latin text) was apparently responsible for laying all the Penn floor tiles at Windsor, although the record of tilers is incomplete and covers only about 25% of the tiles laid in the first phase up to 1357. He laid most of the tiles at a fixed rate per 1,000 and only briefly at a daily rate. He would not have worked without an assistant or two. Simon Billyng was described as his

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TABLE 1 Sales of Penn floor tiles to Windsor Castle[1]

Date order placed	*No of tiles*	*Total cost*	*Cost per 1,000*	*Place*	*Carriage Total cost*	*Carr. Per 1000*	*Supplier/ Remarks*
1332	*8,000*	*16s*	*2s*	*Penn*	–	–	*2 Tilers' stock*
22 May 1350	–	–	–	*{Westminster*	–	–	*Tilers & tiles*
				{Palace & Tower			
				Windsor Castle			
5 Dec 1351	5,000	40s	(8s)	New Vestry			
18 Jun 1352	10,000	65s	6s 6d	Chapter-house	Hedsor 5s	(6d)	John Bovet
27 Aug 1352	10,000	60s	6s	Warden's Hall	Penn 4s	(4.8d)	
30 Mar 1354	3,000	14s 6d	(4s 10d)	Canon's Cloister	Penn 2s	(8d)	
26 May 1354	10,000	(45s)	4s 6d	Canon's Cloister	Penn 6s 8d	(8d)	Robert Tillare
30 Mar 1355	1,500	6s 9d	(4s 6d)	Bakehouse	Penn 6s 8d	–	+3,500 roof tiles
30 Mar 1355	4,000	18s	(4s 6d)	Treasury	Penn 13s 4d	–	+6,000 roof tiles
27 Apr 1355	5,000	22s 6d	(4s 6d)	Treasury	Boatage 9s 2d	–	+4,000 roof tiles
– 1356	16,000	72s est.	4s 6d est	Various works	17s 3d est.	–	89s 3d incl. 5,050 roof tiles & carr./boatage
1356/57	41,000			Six chambers in High Tower etc			
	97,500						
1362/63	84,400	–	–	–	Penn	–	–
	11,000	–	–	–	–	–	–
1363	21,400	–	4s	King's chamber Divers chambers of King & Queen	–	–	In 1362/3, Tilers were paid for laying 152,500 tiles
	(35,700)						
	152,500						

Notes: 1. The 1332 entry at the start of the Table is the earliest record of cost for comparison, although a valuation for tax could well be as low as they could make it, and may be the cost of manufacture.
2. ( ) indicate a figure that does not appear in the original record, but has been calculated from other figures.
3. *Italics* indicate a sale of Penn floor-tiles in this period, but not to Windsor Castle.

[1] Christopher Hohler, *op. cit.*, pp. 6–7 & 22–23. W.H. St John Hope, *op. cit.*, p. 156. Laurence Keen, *op.cit.*, pp.231-2, adds 6 new references found by Stephen Priestley

famulus, i.e. an employee hired for the year rather than a *communis* or casual labourer. In 1365, the word used was *socius,* perhaps best translated as 'mate'.

Before the Black Death, an unskilled labourer earned 1d a day and a master, 4d.[26] Elie had to accept a 25% drop in pay after the initial 20d per 1,000, and then a sharp drop to only 12d, in 1362, presumably when fighting for the first contract of the second phase. This, together with the falling price of floor tiles, suggests strong competition and the need for simple designs so that the floors could be laid as quickly as possible. We shall see that the early Chapter-House floor was a good deal more complicated than the later Treasury floor.

It has been supposed that there is no evidence that Elie the paver came from Penn, but Simon Billyng, his helper, sounds as if he came from the farm in Penn now called Baylins but spelled Belyng in 1325[27] and Belling in 1332[28]. Two newly-found

[26] Lesley Boatwright (Ed), *Inquests and indictments from late fourteenth century Buckinghamshire*, Bucks Record Society, **29** (1994), pp. xliii-xlvii
[27] Buckinghamshire Archaeological Society, Elvey Collection, Looseleaf File 4, Misc. deeds 14th & 15th century, ff 125, 127, 129
[28] A. C. Chibnall (Ed.), *Early taxation returns*, Bucks Record Society, **14** (1966), pp. 45–6

TABLE 2 Payments to Penn tilers at Windsor Castle[1]

Date	*Name of tiler*	*No of days*	*Place*	*Total paid*	*Pay rate /1,000 tiles*	*Pay rate/ Day*
17 Sep 1352	Elie Tilere	5	Wardens	4s 2d	–	10d
	Simon Billyng	–	Hall/Chapter (10,000 tiles)	–	–	–
24 Sep 1352	Ehe Tilere		Chapter House (8,000 tiles)	13s 4d	20d	
12 May 1354	Elie Paviere	6	Canons' Cloister	3s	}	6d
19 May 1354	Elie Paviere	5	Canons' Cloister	2s 6d	}	6d
26 May 1354	Efle Paviere	6	Canons' Cloister	3s	} 15d est	6d
26 May 1354	William Cook	6	Canons' Cloister	Is 6d	}	3d
26 May 1354	William Tillare	6	Canons' Cloister	Is 6d	}	3d
9 Jun 1354	Elie Paviere	2	Canons' Lodging	18d	}	6d
	Williarn Tillare & boy	2	& Cloister			3d
30 Mar 1355	Elye Pavier	4	Treasury	2s		6d
				£1-11-8d		
Nov 62-Nov 63	Elias the paviour	–	6,050 tiles	6s	12d	
Nov 63-Apr 65	Elias the Paviour & his mates	–	Divers chambers of the King & Queen (152,500 tiles)	£8-17-11d	14d	
				£10-15-7d		

[1] The data for this table is taken from Laurence Keen, *op cit.*, pp.321–2

references confirm a Penn connection. [29] The entry for 26 May 1354 starts with the purchase of 10,000 paving tiles for the Canons' Cloister from Robert Tillare of Penn, the cost of carriage from Penn to Windsor and payment to Elie paviere. It then continues, '*Willelmo Cook et Willelmo Tillare deservientis tam eidem paviere quam predictis plaustris' i.e.,* 'to William Cook and William Tillare, workmen for both the same paver (Elie) and for the aforesaid carts'. The two men were to be paid 3d each per day to help him lay the tiles for 6 days. The next entry on 9 June 1354, refers to Elie and his workman William Tillare.

These entries confirm that the tile makers in Penn, the carters and the pavers were all part of the same organisation. Elie the paver was probably from the same family as Simon the paver who paid his taxes in Penn in 1332. A William Tylere features in a Plea Roll in c. 1348. He was one of half a dozen men from Penn, including John the Potter and the Vicar of Penn, charged with breaking into the close belonging to two clerics in neighbouring Wooburn parish, with force and arms, and stealing 100 rabbits, worth 50s. The Sheriff was ordered to arrest them, but sent word that they were not to be found.[30]

If the information from the first two entries, only a week apart, is combined, then, at 10d per day, the total paid of 13s 4d is reached after 16 days. A total of 8,000 tiles laid over 16 days give a laying rate of 500 per day. The 13,000 tiles that were laid in the Canons' Cloister (see Tables 1 & 2) over a consecutive 33 days reveal a laying rate of 394 per day. Similarly, the last entry for 1363/5 shows that 152,500 tiles were laid over a 75 week period. Holidays of four days to a week were generally taken at Christmas and Easter and religious observance required a shorter working day on feast days – there were about forty such days in the year by the later Middle Ages.[31] Suppose, for argument's sake, he

[29] Laurence Keen, *op. cit.*, p. 232
[30] Plea Rolls, c. 1348 (PRO: de Banco Rolls, CP 40/392/24)

lost five weeks for feast days, sickness and cold weather, then for 70 weeks he would have had to lay 2,178 tiles every week, again averaging about 400 per day over a five or six day week.

Presumably, other workmen repaired the mortar base for the new tiles, but Elie and his mates had the difficult task of ensuring that the paved floor was flat and level as well as getting the pattern right. They must have worked long and hard right through the winter months, by candlelight and often in large, cold rooms. Laying the floors was the last task before the room was finished and their fixed rate gave them every incentive to finish the job quickly. The record for the Canons' Cloister suggests that Elie worked a six-day week when he could. This high level of dedication, experience and expertise would have been difficult for any rival to match and must have been a major factor in Penn's continued success.

Penn roof tiles

Table 3 shows all the known sales of roof tiles to Windsor Castle and to Salden Manor, Mursley, in Buckinghamshire.[32]

TABLE 3 Sales of Penn roof tiles to Windsor Castle and Salden Manor[1]

Date	*No*	*Total cost*	*Cost per 1,000*	*Place*	*Carriage Total cost :& per 1,000*	*Remarks*
1332	7,000	6s	(10¼d)			Penn tilers' tax return in 1332
				Windsor Castle		
1344	40,000	80s	2s	Round Table	10s : 3d	+6,000 laths, 32,000 lath nails, 40,000 tile pegs, 4,000 board nails – £2 16 8d
1353	20,000	46s 8d	2s 4d	Bake/Brewhouse }	4s : 2.4d	Fm Robert Tillare of Penn
	300 ridge	7s	23s	Bake/Brewhouse }		
Sep 1353	*18,000*	*64s 9d*	*3s 6d*	*Bakehouse*		*Fm John Bithewood*
Sep 1353	*10,000*	*23s*	*2s 4d*	*Bakehouse*		*Fm Simon Molder of Chalfont*
	3,000	7s	(2s 4d)	Bakehouse		Fm Robert Tillare of Penn
30 Mar1354	3,500	8s 2d	(2s 4d)	Bakehouse		+ 4,000 tile pins for 10d
13 Apr 1354	6,000	14s	(2s 4d)	Treasury		+ (1,000) tile pins for 2½d
1354	4,000	9s4d	(2s 4d)	Treasury		
1356/7	16,000					
	37 valley					Cost incl with paving tiles
1356/7	5,050					
1357	100,000	(267s)	2s 8d	Salden	4d est	2s 8d include carriage cost
	11,500	(29s4d)	2s 8d	Salden	4d est	2s 8d include carriage cost

Notes: 1. The 1332 entry at the start, of the Table is the earliest record of cost for comparison, although a valuation for tax could well be as low as they could make it and may be the cost of manufacture.
2. ( ) indicate a figure that does not appear in the original record, but has been calculated from other figures.
3. *Italics* indicate the only two recorded suppliers not from Penn in this period.

[1] These figures are a composite from Christopher Hohler, *op. cit.*, pp. 22–3 and W.H. St John Hope, *op.cit.*, I, pp. 118,156

[31] Eamon Duffy, *The stripping of the altars,* Yale University Press, New Haven and London (1992), pp. 41–2 and L. F. Salzman, *Building in England down to 1540* (1952), pp. 64–5, list the feast days and typical working hours

[32] These figures are a composite from Christopher Hohler, *op. cit.*, pp. 22–3 and W. H. St John Hope, *op. cit.*, I, pp. 118,156

A number of interesting conclusions can be made, which throw more light on the floor tiles:

- Robert Tillare made roof tiles as well as paving tiles.
- He also made ridge tiles, expensive ones costing ten times as much as ordinary roof tiles. The 1353 reference describes them as *rugtil*. Ridge tiles were used from the twelfth century onwards as decoration on the top of important buildings, even those roofs with lead or stone tiles. They were usually lead-glazed and often with elaborate crests and so required skilful manufacture[33]. The 1356/7 reference is to *cavatis tegulis*, perhaps curved 'valley' tiles or gutter tiles. If these skills already existed in Penn, possibly with the tiler of 1222, then it may well have been another reason for the subsequent growth of the decorated tile industry.
- The cost of the laths, pegs, and nails for the £4 worth of tiles sold in 1344 was surprisingly high at £2 16 8d, nearly two-thirds of the cost of the tiles themselves. If a two-thirds element is added to the 2s 4d cost per 1,000 for the tiles sold in 1354, the value of the order rises to nearly 4s per 1,000. This compares with 4s 6d per 1,000 for floor tiles at the same period. If it was generally the case that the Penn roof tilers provided these items, it adds another dimension to their industry. Roof tiles were therefore a very important part of Penn's tiling industry.
- From 1353 to 1357, the total recorded sale of Penn roof tiles (169,050) was nearly twice that of floor tiles (97,500).
- The data for the price of roof tiles is limited, but there does not seem to be the same evidence of competitive pressure that drove down floor tile prices.
- From 1212, alternatives to thatched roofs were increasingly encouraged by law in London to reduce the danger of fire, and tiles were named as one of the recommended alternatives. In 1350, after the Black Death, their price was fixed by the City Corporation at 5s per 1,000, and in 1362, after a great tempest, it ordered that the price of tiles should not be raised or kept back to enhance the price.[34] The comparatively low price of Penn tiles, at 2s 4d, must have been very attractive.
- Carriage costs were 2½d to 3d per 1,000 to Windsor and 4d for the longer, 30 miles to Salden. This is half as much as the 8d per 1,000 for floor tiles even though a roof tile was over twice as long and three times as heavy as a floor tile. The higher price must reflect the extra care needed in packing decorated floor tiles and the greater likelihood of losses from chipping and breakage.

Some of the floor tiles can still be seen in several places in Windsor Castle:

The Aerary – as the former Treasury is known, is above the porch leading to the vestry at the NE corner of St George's Chapel. It has the only complete floor of Penn tiles still in use in the Castle. These were the tiles laid in 1355 by Elie Pavier, in four days, if the record is complete. Laurence Keen, has recently published a drawing of the central part of the floor, with a detailed discussion and photographs.[35] Photographs of some of the tiles and a computer reconstruction of the floor are shown at Fig. 3. Seven different decorated tiles were used, some as singles, some laid in fours, to make up six separate bands of tiles running the length of the room, set symmetrically on both sides of a central line of alternate dark and decorated single tiles. The floor is very badly worn, except at the edges, and there have been many repairs over six and a half centuries, often using the wrong tiles. The tiles seem to have been laid butted together and, because they vary in size, the rows are not all straight across the width of the room. Some of the tiles used were never perfect specimens in the first place. A chequered pattern of dark and decorated tiles was used at the doorway and another single pattern in the lobby.

The main part of the floor uses ten designs and eight of them are the same as those found in the gardens at the end of Beacon Hill in Penn (See Local Gazetteer at Appendix 1). The room is 23½ x 11½ ft and would therefore have needed only 1,920 tiles with a few more for the lobby, about 2,000 all told. This does not match the 9,000, perhaps 10,500

[33] Elizabeth Eames, *English tilers* (1992), pp. 6, 11, 12

[34] L. F. Salzman, *English industries of the Middle Ages*, p. 174; n. 1, p. 175 observes that the monks of Boxley got as much as 10s per 1,000 for some of the tiles from their tilery in 1350.

[35] Laurence Keen, *op. cit.*, pp. 219–37. Tile designs were: P44, 58, 62, 67, 74, 85, 88, 101, 153, 155, 158, E2027

tiles ordered for the Treasury and so it may be that the Treasury occupied additional rooms at the time, or that 'Treasury' was used as shorthand for a much wider placement.

The overall effect when the tiles were newly laid must have been very striking. There were a few mistakes in the detail, both in the sequencing and in the occasional introduction of a strange tile, presumably a mistake or because the right tile was not available. We have already noted the formidable pace at which the paviours had to work. Haberly supposed that detailed plans were worked out in crayon or charcoal on large drawing boards, whose purchase is recorded in medieval building records, but leaving the paviour free to amend the plans in the light of the tiles he actually had to hand. Because numbers were counted clumsily in Roman numerals, it would have been easy to make mistakes and a paviour would sensibly order more tiles than he needed.[36]

The High Tower – (now called the Round Tower) was converted into a temporary palace between 1353 and 1358. This cost the then vast sum of £5,000 and included 41,000 paving tiles ordered from Penn in 1356/7. When William of Wykeham became Clerk of Works, in 1356, he received 11,000 floor tiles from his predecessor, Robert of Burnham, and in his accounts after one year of office, he states that he has bought 41,000 more himself and has laid 45,000 out of the total for paving the six chambers of the High Tower and other places in the castle[37]. Strengthening work on the foundations of the tower in 1989, to prevent it leaning like the Tower of Pisa, revealed many of these Penn tiles, heavily worn by long usage and discarded when Prince Rupert remodelled the Tower in the seventeenth century.[38]

A recent assessment report, by Ian Betts, records the discovery of parts of some 163 Penn floor tiles. Nearly half were too worn or fragmentary to identify, but there were 76 identified decorated tiles of 20 different designs from the Tower. One new design was discovered as well as plain glazed tiles of various colours. Five of the designs are shared with the Aerary. There were also plain glazed tiles amounting to over 10% of the total.[39]

Chapter-house of the Knights of the Garter – The Deanery of St George's is on the site of the former Chapter-House where excavations, in 1989, found a small area of *in situ* tiles. Like the Aerary, the floor was laid in patterned bands running along the length of the room, with each band separated by a row of single tiles of a different pattern. Unlike the Aerary, the tiles were laid at 45° to the walls and therefore required triangular half tiles along the edge of each band to obtain a straight line. There was also a nine-tile circular pattern, rare for Penn tiles (Fig. 12).[40] These were the 8,000 tiles laid by Elie Tilere, who was paid 13s 4d on 24 September 1352.

The extra complications of the triangular tiles and the nine-tile circular pattern probably reflect the high status of the room. It was only the second floor Elie had laid in the Castle and was expensive. He may well have decided, subsequently, to dispense with elaborations where possible in order to speed up the laying process. The Aerary, which was laid later, is a much more straightforward floor.

Governor's House (Norman Gate, South Tower, 1st floor) – There is an *in situ* floor with 609 decorated and 217 plain Penn floor tiles. There are also 315 badly worn tiles in the floor, many of which are probably also of Penn type. A total of 29 decorated design types are present, but only one of the designs is part of the original floor since the others have all been added during later repair work. The one original design has not been seen before and is closest to P152/153. It makes up a four-tile pattern and has been used in bands separated by plain panels to make up a very effective floor.[41]

[36] Loyd Haberly, *op. cit.*, pp. 42–3

[37] Christopher Hohler, *op. cit.*, p. 7, 23 fn. 20

[38] Stanley and Pauline Cauvain and the author visited the English Heritage Excavation Unit towards the end of their work at the Round Tower in November 1989. We also saw the floor of the Aerary

[39] Ian Betts, *Windsor Castle. Assessment Report on decorated and plain floor tile,* Museum of London Specialist Services (1998). The four most popular designs, all elaborate, are: P54, 63, 153, E2551. The five designs shared with the Aerary are P62, 67/8, 101, 158 (possibly), E2027

[40] Laurence Keen, *op. cit.*, pp. 225–6. He includes a drawing of the arrangement of the bands, although not with the detail of each tile. He notes that Hohler recorded only three designs for a 9–tile pattern of Penn tiles: P117, 171, 172

[41] Tom Cromwell and Ian Betts, English Heritage Centre for Archaeology, *CFA News*, Winter 2002–2003, no. 4, pp. 10-11

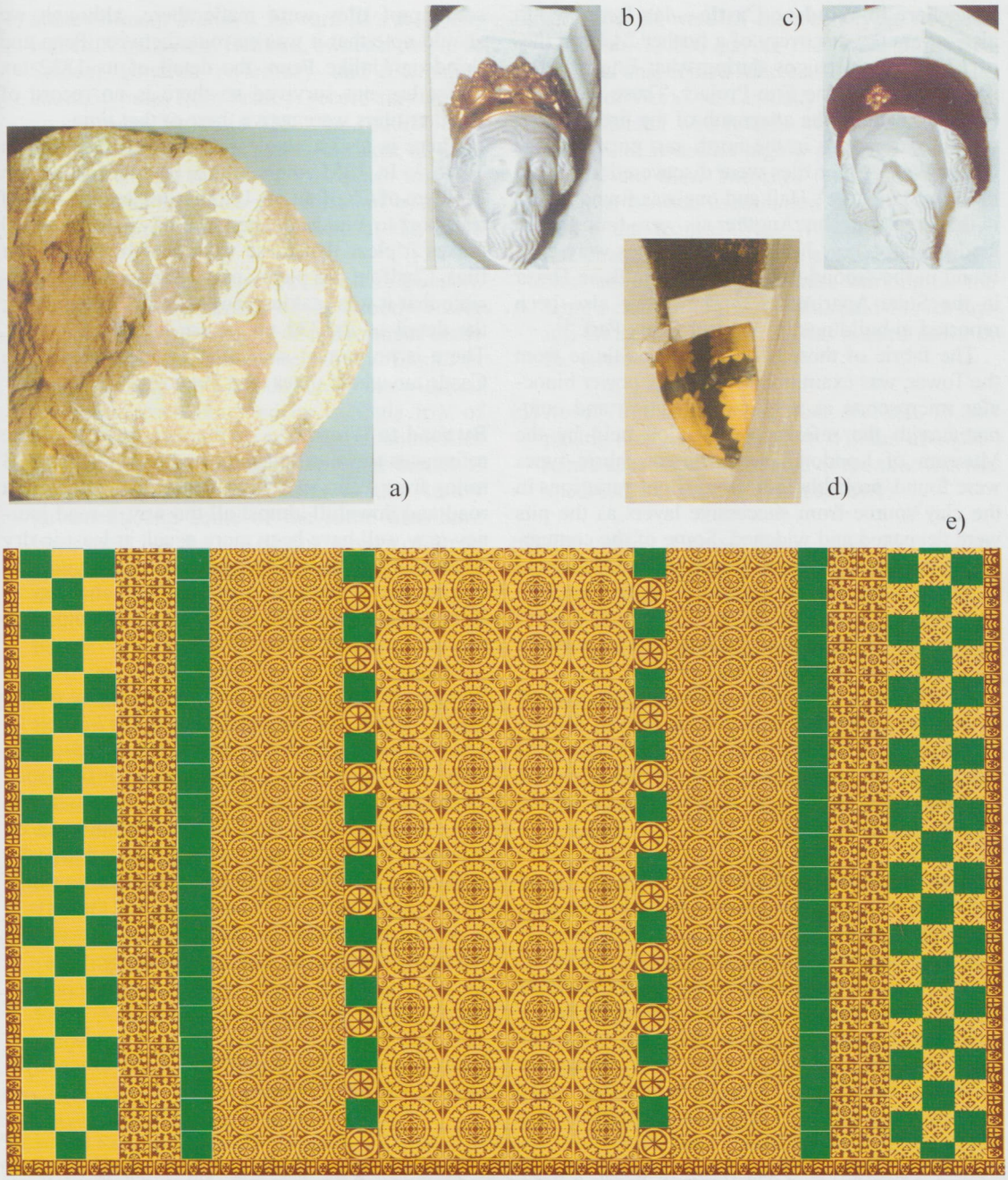


FIGURE 2 a) Part of a unique, 6″ square, early Penn tile found at Yew Tree Cottage, Penn. b) Roof corbel in Penn Church, supposedly Edward III. c) Another corbel, supposedly a caricature of Richard II. d) Another corbel, Sir John de Mohun's shield. *Photographs by Eddie Morton* e) The chancel floor of Penn Church - A computer representation of how it may have looked using the tiles known to have been removed from the chancel in 1918. *By Bill Bundy, modifying a design by Diana Hall*

Elsewhere in Windsor Castle – Ian Betts' report also covers the discovery of a further 24 Penn tiles of 12 different designs during what English Heritage refer to as the Fire Project. These were discoveries made in the aftermath of the fire of 1992, during excavations in the north east corner of the Upper Ward. Floor tiles were discovered in a vault infill in St George's Hall and one was found *in situ* in the Great Kitchen. Another six were found when landscaping a new Jubilee garden. Tiles were even found in the second-floor lobby of the Rose Tower in the State Apartments.[42] They have also been reported in buildings in Windsor Great Park.[43]

The fabric of these tiles, as well as those from the Tower, was examined using a low power binocular microscope at x 10 magnification and compared with the reference collection held by the Museum of London. Five different fabric types were found, probably indicating slight variations in the clay source from successive layers as the pits were deepened and widened. Some of the contemporary peg-roof tiles were also examined and found to use the same clay as some of the floor tiles. This supports the documentary evidence that Robert Tillare supplied both roof and floor tiles to Windsor in 1353 and 1354 respectively.

A Penn tile from the English Heritage excavation at Windsor Castle was examined as part of Stanley Cauvain's investigation of the use of the 'chemical fingerprint' of a ceramic to identify its source. He confirmed that Penn was a likely source of the tile.[44]

Hedsor, Hedgerley and Chalfont – Hedsor was an important wharf for the Thames and was a staging post only six miles from Penn. Table 1 has one reference to Hedsor and two references to 'boatage', but there is no evidence that tiles were made at Hedsor. There are also two references in the Windsor Castle accounts of 1344 and 1356/7 to the carriage of roof tiles from Penn and Hedgerley (written as Hoggle and Hoggele) to Windsor. Since Hedgerley has plenty of clay it is not unlikely that some roof tiles were made there, although we should note that it was en route between Penn and Windsor. Unlike Penn, the detail of its 1332 tax return has not survived so there is no record of whether tilers were active there at that time.

There is also a single reference to Chalfont in Table 3. In 1353, there was a payment to Simon Moldere of Chalfont for 10,000 tiles and the cost of transport to Windsor. The price of 2s 4d per 1000 makes it clear that these were roof tiles not floor tiles. Chalfont has plenty of clay and it is very possible that it was making roof tiles. Like Hedgerley, the detail of its1332 tax return has not survived. There is no named source of paving tiles for the Castle anywhere other than Penn.[45]

By road to Windsor – As there are only the three references to water transport and as it was only 13 miles from Penn to Windsor by a well-used main road and downhill almost all the way, a road journey may well have been more usual, at least in dry weather. There would have been great advantage in leaving the deliveries on the carts all the way to Windsor, to avoid both the loading and unloading and the extra cost of hiring a boat.

Evidence that it was more costly by river to Windsor is suggested by the two successive orders for 10,000 tiles in June and August 1352 (Table1). The first had carriage costs of 5s from Hedsor, the second 4s from Penn. Further evidence of a road journey is the entry in 1354 which starts with the cost of carriage from Penn to Windsor and goes on to refer to William Cook and William Tillere, who were being paid to help Elie lay the tiles, as workmen for both the paver (Elie Pavier) and the carts.[46] It seems reasonable to assume that the carters stayed on to help Elie after delivering the tiles.

Other Royal Sites

Penn tiles were also supplied to many other royal sites as well as to Windsor:

[42] Laurence Keen, *op. cit.*, p. 220. He cites S. Brindle & B. Kerr, *Windsor Revealed: New light on the history of the Castle* (London 1997), pp. 25, 44

[43] Elizabeth Eames, *Catalogue,* I, p. 183. They have been found in the garden of Virginia Water Cottage on the site of the medieval manor

[44] Stanley Cauvain, *op. cit.* as in fn 11, pp. 146, 152

[45] Christopher Hohler, *op. cit.*, pp. 7, 22–3. Elizabeth Eames, *op. cit.*, p. 221. A. C. Chibnall (Ed*) Early taxation returns,* Buckinghamshire Record Society, **14** (1966)

[46] Laurence Keen, *op. cit.*, p. 232

(1) *Salden Manor, Mursley.* Edward III's daughter, Isabell, Countess of Bedford, owned a manor at Salden, between Aylesbury and Bletchley, about 30 miles from Penn. A record survives of an enormous order, in 1357, for 100,000 roof tiles (see Table 3), including the cost of their carriage in 200 carts over 15 leagues from La Penne to Salden. This was followed by a further order for 11,500 roof tiles at the same price.[47]

(2) *Westminster Palace and the Tower of London.* The first-floor chamber of the Bloody Tower contains the greater part of a pavement made up of Penn tiles, which were found *in situ* in 1974.[48] There are 6 bands across the width of the room, each bounded by a single row of green glazed tiles. The grouping of some tiles in fours, together with 6–tile wide bands of single-design tiles is similar to the Aerary pavement, and some of the same tiles have been used, but the use of single rows of green glazed tiles to separate the main bands and the use of a chequer pattern of plain green and yellow tiles to form a 6–tile wide band is new.[49]

(3) *Whitehall Palace.* The design of the chapel floor in the palace is known from a plan made during an excavation in 1939. Little of the floor survived, but enough to suggest that it was all of decorated Penn tiles. There were at least three wide bands parallel to the longer walls, with some of the tiles grouped in fours. The single rows dividing the bands were also decorated.[50]

(4) *Baynard's Castle, City of London.* This was a very important stronghold built by William the Conqueror just inside the City wall, near St Pauls. A number of decorated paving tiles were recovered from the site in the nineteenth century and all were of the Penn type. Between 1361–66, 13,000 paving tiles were purchased from an unspecified source at 10s per 1000. The Clerk of Works was initially the same William of Wykeham who bought 41,000 floor tiles in 1356, and it seems highly probable that they were Penn tiles. The tiles (sufficient to pave 1828 sq ft) were used in new buildings built to house the King's Great Wardrobe, including one chamber for the tailors and another for the skinners or furriers who were working on the King's clothes. John Lane was paid 12s for laying the tiles.[51] The castle was burned down in the Great Fire of 1666.

(5) *Royal Palace at Eltham, Kent.* In 1366, 15,000 paving tiles were ordered by William of Wykeham's successor. The source of the tiles was not specified, but Penn is a possibility.[52]

(6) *Kennington Palace, Surrey and The Mount, Princes Risborough, Buckinghamshire.* Both belonged to the Black Prince and Penn tiles have been found in the hall and in a first floor chamber of the Palace and in five of the living rooms of The Mount where there was an important stud farm.[53]

(7) *Royal Palace of Sheen, Surrey.* Between 1384 and 1388, the King's Master Mason was paid 8 shillings for 1,000 decorated Penn tiles for paving a new house and other chambers. There was another unspecified order for 2,000 decorated tiles to pave the room set aside for the King's bath. Some years earlier, in 1366 and 1367, the kitchen and a new chamber were paved by Robert Herewyk, a paviour, who laid 14,000 tiles at 20d per 1,000. In 1370, a new chamber beside the gate was paved. The source of the tiles was not specified in the record,

[47] Christopher Hohler, *op. cit.*, p. 22, fn. 17

[48] Elizabeth Eames, *Catalogue*, I., p. 225

[49] Laurence Keen, *op. cit.*, p. 227. He cites P. E. Curnow, 'The Bloody Tower', in *The Tower of London:its buildings and Institutions*, ed. J. Charlton (London 1978), pp. 555–61, which includes a plan and illustrations

[50] Laurence Keen, *op. cit.*, p. 227. He cites S. Thurley, *Whitehall Palace: An architectural History of the Royal Apartments, 1240-1690,* Yale University Press, New Haven (1999), fig 9 on p. 4

[51] Elizabeth S. Eames, *Catalogue*, I, p. 223

[52] Ibid., p. 223

[53] Laurence Keen, *op cit.*, p. 228. He cites G. Dawson, *The Black Prince's Palace at Kennington, Surrey*, British Archaeological Reports, 26 (1976), pp. 104 -5. F. H. Pavry & G. M. Knocker, The Mount, Princes Risborough, Buckinghamshire', *Records of Buckinghamshire*, **16**, part 3 (1957–8), pp. 131–178. Great quantities of Penn tiles were found with 12 different designs (p. 156), all of the mass-produced, post-Black Death variety

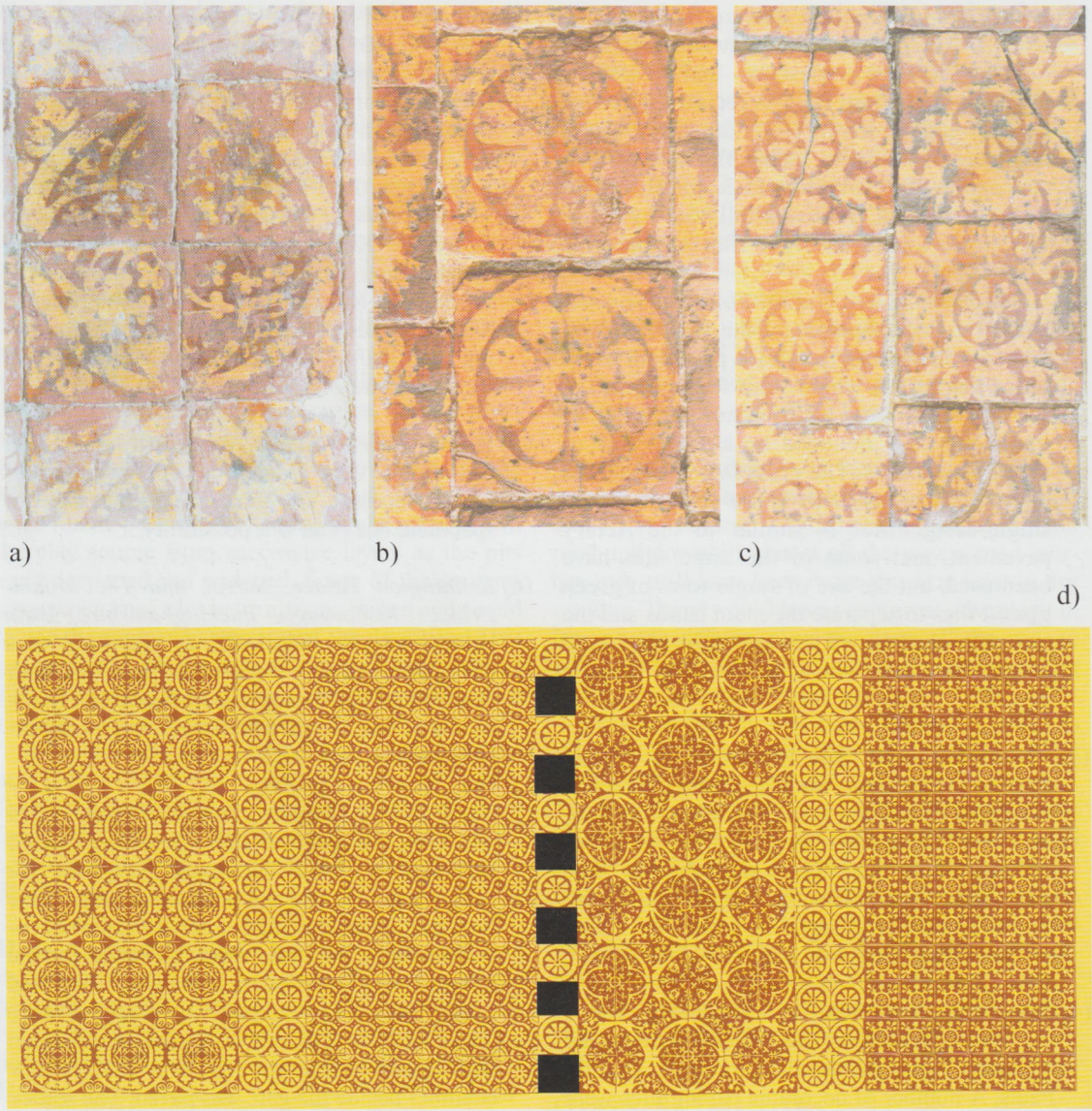


FIGURE 3 a), b), c) Tiles from the Aerary floor, Windsor Castle. *Photographs by Eddie Morton*
d) The Aerary floor in an idealised computer portrayal that assumes a uniformity of size, placing and colour that was impossible to achieve in practice. *By Bill Bundy*

almost as if it was too obvious to note. Unfortunately, none of the tiles have survived because Richard II had the palace demolished after his Queen, Anne of Bohemia, died there in 1394. The materials were reused elsewhere including 1,000 tiles (whether roofing or paving tiles is not clear) for St George's Chapel, Windsor.[54]

[54] Elizabeth Eames, *Catalogue*, I, pp. 222–3

(8) *Tower of London.* The last recorded payment for Penn paving tiles was in 1388. It was a payment of 2s 5d to the King's Master Mason for 296 tiles (i.e. at a rate of 8s per 1,000) for paving and repairing the pavement below the private garderobe of the King in the Tower of London.[55]

Penn's Connections At Court

There seems to have been a tradition of royal service in the de la Penne family that may have contributed to the necessary influence at Court. A Hugh de la Penne, who died in 1276, was Treasurer to Queen Eleanor and another Hugh, who died in 1331, was Usher to the Queen.[56] A John de la Penne was King's Clerk in 1359.[57] The lords of the manor themselves also held royal appointments. Sir John de la Penne was Knight of the Shire and Commissioner of Array (responsible for preparing armed local levies against feared invasion, usually by the French) for several years up to 1332 and his son John was the Commissioner for Taxes from 1350 to 1354[58]. Thomas atte Penne was one of ten Commissioners of Array for the county in 1385 and 1392 with the additional task of preparing 'bekyns' in case of French invasion.[59]

There is also indirect evidence of the possible involvement of another wealthy patron, Sir John de Mohun (1320–75). His mother was the daughter of Sir John de Segrave who held the Segrave manor in Penn until 1325. The Mohun shield was identified on the corbel in the north west corner of the nave of Penn church when the corbels were all cleaned and repainted in 1952 (Fig. 2d). He was a follower of the Black Prince and was the eleventh of the original knights of the Garter. His small wooden shield with the same coat of arms as on the Penn corbel can still be seen amongst the Garter stall-plates in St George's Chapel, Windsor. One of his daughters married Edward, Duke of York and his widow remained active at Court until her death in 1404.[60]

A connection with Beaconsfield has also been established. On 22 May 1350, three men, John de Alkeshull, Richard Gregory and Ralph Hikebidde were appointed to take tilers for some works in Westminster Palace and the Tower of London, with carriage for bringing the tiles from Penn and payment for the same to be made at the Exchequer.[61] It has been assumed that it was only the tiles and not the tilers that came from Penn, but this is almost certainly not so because two of the men appointed, John de Alkeshull and Richard Gregory, came from Beaconsfield, Penn's nearest neighbour.

The impressment of both men and materials was part of the royal perogative of prise or purveyance – the right of pre-emption – by which the king's requirements took precedence over those of the general public.[62] John de Alkeshull of Beaconsfield was the King's purveyor of building materials of all kinds. He had the right of pre-emption in every county of England and it was his duty to agree the price and then send the materials and men wherever they were needed – to Westminster, to Windsor, to Bristol – certifying the bill for payment at the Exchequer. In the Windsor Castle accounts he is described as 'the provisor of the King's works' and was paid at a rate of 6d per day for much of the year (274 days). He worked under the King's Clerk, Robert of Burnham, another close neighbour, who earned 12d per day. He appears in the accounts from 1353 to 1355, and from 1360 to 1364 he was appointed annually to take various tradesmen 'for the King's works at Windsor'. He died in 1364, having served the king for the previous forty years.[63]

Richard Gregory, a lawyer and coroner for Buckinghamshire, appears in the record from 1321 to 1385. He had the second largest estate in Beaconsfield (later to be known as Gregories, owned by

[55] *Ibid.* p. 222

[56] *Calendar of Liberate Rolls*, V (1270), p. 168 and B. F. and C. R. Byerly (Ed), *Records of the Wardrobe and Household 1285–9* (1977 & 1986),

[57] *Calendar of Patent Rolls* (1359), p. 232

[58] *Members of Parliament* 1213–1874, I, p. 57 & 75. *Calendar of Fine Rolls* (1322), 3, p. 124

[59] *Calendar of Patent Rolls* (1385), p. 58 & (1392), p. 89

[60] *Dictionary of National Biography*, 13, p. 555

[61] J. G. Jenkins, *History of Penn* (1935), p. 55. He cites a *Calendar of Patent Rolls* (1350), 24 E 3, p 531

[62] L. F. Salzman, *Building in England down to 1540*, Clarendon Press, Oxford (1952), p. 37

[63] W. H. St John Hope, *op. cit.*, I, pp. 158, 172, 173, 219. Gerald Elvey, 'Medieval scene', *The Book of Beaconsfield*, Clive Birch (Ed), (1976), p. 23. Elvey was Editor of *Records of Buckinghamshire* at the time and was clearly drawing on extensive archive material, though the book is not referenced

Edmund Burke in the eighteenth century) as well as land in several of the surrounding villages. His close involvement with Penn is confirmed by his name appearing twice in the 1372 accounts of Segrave Manor, the smaller of the two manors in the parish.[64] His daughter's son was the king's butler. A Gregory younger son, did well in the City of London and had money to lend for mortgages in Beaconsfield.[65] Furthermore, there is a record that Richard's son, Richard Gregory Junior, was owed £4 by Walt. Baldewyne of Penn, a tiler, in the late 1340s.[66] Thus when we see that 185,000 paving tiles were bought from Richard Gregory, in 1357, for Westminster Chapel, at 6s 8d per 1,000, the probability is that we are looking at the largest recorded order for Penn tiles.[67]

The Distribution, Transport And Survival Of Tiles

Distribution

Christopher Hohler's stated purposes were to publish all the designs found in or recorded from Buckinghamshire; to throw the work of Haberly into perspective and to bring out the importance of the tileworks at Penn. He inspected and drew all the tiles in Buckinghamshire, Oxfordshire and London and, for other locations, he consulted documents already in print. His two articles combine to give both a drawing and description of each design that he found and its various locations. He found that medieval paving tiles from Penn have a wide and massive distribution, the majority within striking distance of Penn itself or of the navigable parts of the Thames. He found them in 29 places, mainly in churches and other ecclesiastical buildings, all over Buckinghamshire, and in nine neighbouring counties. In London, he found that they were installed in royal palaces, monastic buildings and churches, but seldom in private houses.[68]

Hohler acknowledged that after the suppression of the monasteries, in the 1540s, there were plenty of second-hand paving tiles on the market as well as some known cases of movement of tiles, such as those in Missenden Abbey that are now on the floor of Great Missenden Church. Despite what he described as these serious reservations, he concluded that there is no reason to doubt that, as a rule, tiles are still to be found where they were laid in the Middle Ages.[69]

Hohler's List V, headed ' "Printed" tiles probably from Chiltern factories', shows 173 different designs, but he was only able to ascribe 26 of them certainly to Penn, because only three Penn sites were known when he was writing his articles in 1941. There were 7 tiles from Penn Church; 13 from a presumed kiln site (Stratfords Cottage – T2 on Fig 1); and 6 from Windsor Castle, all of which were firmly attributed to Penn by documentary evidence.[70] It was this paucity of direct evidence from Penn, together with what Hohler allowed to be the possibility that Hedsor might also have been manufacturing paving tiles that seems to have led to his cautious heading of 'probably from Chiltern factories'. It is now accepted that there is no evidence of any significant contemporary rival manufacturer in the south-east and over 200 designs are now attributed to Penn.[71]

John Schofield's 1994 study of 108 Saxon and medieval parish churches in the City of London, included an Appendix by Ian Betts on the medieval tiles found in them. Only three still have a few medieval tiles *in situ,* but archaeological excavation has revealed evidence of former tiled floors in a further 18 churches. Floor tiles, now lost, from a further five churches, are referred to in museum records. Penn tiles were found in 20 out of these 26 churches and provided the overwhelming majority of the fourteenth century decorated tiles. They were mostly installed between the 1350s and 1380s.

[64] J. G. Jenkins, *A history of the parish of Penn* (1935), pp. 46–7. Gregory was taking over the dovecot and buying cattle and other animals after the death of the lord of the manor.
[65] Gerald Elvey, *op. cit.*, pp. 23–4
[66] CP/40/38/74 and see fn. 16 above. *VCH Bucks*, III, p. 160, has seven references under 'Gregory's Manor', to Richard Gregory, father or son, in the fourteenth century
[67] L. F. Salzman, *English industries of the Middle Ages*, pp. 182–3, n. 3. He cites Exch. K. R. Accts., 472, no. 4. If carriage costs were not incl in the 6s 8d, Gregory made a 50% profit for arranging the order
[68] Christopher Hohler, *op. cit.*, p. 1, 6–12
[69] Christopher Hohler, *op. cit.*, pp. 1–2
[70] *Ibid.* pp. 7, 9, 104–22.
[71] *Ibid.* p. 15 The Little Brickhill paving tiles, described by Hohler as of 'atrocious design with their manufacture little better', belong to the late fifteenth or early sixteenth centuries and so were not contemporary with the Penn tiles.

Betts concluded that they represent only a tiny fraction of the original total and that many, if not most, medieval City churches would have had areas of plain or decorated glazed floor tiles, since lost to the Great Fire of 1666, to later repairs and rebuilding in the following centuries, and finally to bomb damage during the last war.[72]

Penn tiles have been found in many former monastic buildings such as Charterhouse; St Mary Spital, Smithfield; Priory of the Hospital of St John of Jerusalem, Clerkenwell; Bartholomew's; Christ's Hospital. Only the first three of these discoveries have yet been published, but The Museum of London is gradually getting through them and new tile designs, not in Hohler or Eames, are being discovered.[73]

Laurence Keen has recently published a comprehensive gazetteer of sites with Penn tiles. He has been able to increase Hohler's total of 76 sites in 10 counties to 180 sites in 18 counties outside London, extending as far north as Coventry, as far west as Somerset and even to the Scilly Isles. In London, he lists a further 80 identified sites. He has also published a map of sites in the Home counties area, of which the dominant characteristics are proximity to Penn or to the Thames, both upstream and downstream. Some places were well beyond the reach of the flat- bottomed Thames barges of the time and Keen suggests that London-based middlemen may have arranged both sales and transport. Where necessary, cargoes of tiles would have been transferred to sea-going vessels to get to sites near Portsmouth, Bristol (St Mary Redcliffe) and Tresco in the Scilly Isles.

Keen's gazetteer identifies 55 sites in Buckinghamshire and includes some famous places elswhere. Savoy Palace in London and Pyrgo Palace in Essex are additions to the royal palaces already discussed. The cathedrals of Canterbury, Winchester and Hereford, numerous abbeys and priories, Berkhamsted Castle and Pleshey Castle in Essex, are all listed. Chacombe Priory in Northamptonshire, which was the proprietor of Penn Church, is included.

Carting

The record shows that 200 carts were used to carry 100,000 *roof* tiles for Salden Manor in 1357.[74] This tells us that a cartload was 500 roof tiles. Each roof tile weighed about 3 lbs, making a total of 1500lbs, which together with a few sacks of lime and sand and perhaps a second man, would have made a total cart load of some 2,000 lbs. This is close to the one ton (2240lbs), supposed to be a reasonable load for a horse to pull, although the load must have depended on hills, potholes and the weather. By the early fourteenth century, horses had replaced the slower oxen for this type of work.[75]

A *floor* tile weighed about 1lb and so, with the same assumptions, a cartload of floor tiles would have been made up of 1,500 tiles, plus some bags of lime and sand and a second man.

Floor tiles were generally sold in lots of 1,000 and it seems likely that they were packed in bundles, perhaps in wooden boxes with straw both to keep them immobile and undamaged and for manhandling. This probably explains why the carriage cost for floor tiles seems to have been twice that for roof tiles, despite being smaller and lighter. A box of 100 floor tiles would seem to be a convenient sub-division of 1,000 and its 100lb weight could be readily handled by a fit young tiler. Such a box could conveniently have had 5 layers, 4 tiles wide and 5 tiles long. This would have been very compact, only 1½ ft wide, 2 ft long and ½ ft high.

15 such boxes would have made up the cartload and would have occupied only a surprisingly small space. 12 of the boxes could have been laid out in a single layer on the floor of a cart 4½ ft wide and 6ft long. The carts, made by local carpenters and blacksmiths, may well have been deliberately designed to be smaller and more manageable than

[72] John Schofield, 'Saxon and medieval parish churches in the City of London: a review', *Trans. London & Middx Archaeol. Soc.*, **45** (1994), pp. 23,26,27, 133–40

[73] I. M. Betts, 'Ceramic & stone building material', *The London Charterhouse* (Eds B. Barber & C. Thomas), MoLAS Monogr ser 10 (2002), 97. N. Crowley, 'Ceramic building material', *Excavations at the priory & hospital of St Mary Spital London*, (Eds C. Thomas, B. Sloane,C. Phillpotts), MoLAS Monograph Ser. 1 (1997), 198. Terence P. Smith, 'Other stone and ceramic building material', *Excavations at the Priory of the Order of the Hospital of St John of Jerusalem, Clerkenwell, London,* MoLAS Monograph, 20, 2004, Appx 7. 3, pp. 324–5 & Fig. 97 illustrates six new designs, not in Hohler or Eames

[74] Christopher Hohler, *op. cit.*, p. 22, fn. 17

[75] L. F. Salzman, *Building in England down to 1540* (1952), p. 352, explains the meaning of *plaustrum*, the Latin word used for a cart, wagon or wain. A standard roof tile (10½ x 6¼ x 5/8 ins) weighed nearly three times as much as the 1lb floor tile

the normal medieval farmer's and carter's four-wheeled wagons or wains shown in contemporary illustrations. All the tiles would have left Penn in carts. Customers may well have provided their own horses and carts, if they had them, since they were paying the cost of carriage.

The driver sat on the horse. Heavily laden carts could be dangerous, as demonstrated by the tale of the carter carrying a load of 650 tiles from Halton to Wendover in 1378. He fell in front of the cart and 'its wheel broke his neck and shattered his head as far as the brain, from which he died at once, by accident'. The cart, the horse and the tiles were valued at 13s 4d.[76]

River transport[77] – River transport downstream from Hedsor was an attractive proposition, particularly as far as London, because it was both quicker and cheaper than by road for longer journeys. The chief obstacles to boats on the Thames were mill-dams, somewhat resembling modern weirs, which blocked the river's entire width and built up costs in tolls and time. Each dam contained a narrow gap where the water was held back by removable paddles, i.e., a flashlock, from which, when opened, the water gushed downstream raising the water level over the shallows below the lock and so allowing the passage of boats up or down. (The poundlocks that are familiar to us today did not start to replace flashlocks until after an Act of Parliament of 1770).

Mill operators opened locks at their convenience and merchants' boats could be held up at a lock for two or three days. There was only one such obstacle (Boulter's Lock at Maidenhead) between Hedsor and London, but upstream it was a very different story. There were 4 mill-dams up to Henley, a further 3 to Reading and another 17 on the journey up to Oxford which could take ten days. Apart from the delays and costs, there was some risk of damage and loss of cargo, particularly if a cable broke as the boats were winched laboriously up and over the open flashlocks; even more so in summer when the river levels were lower.

By 1300, Henley was established as the major entrepot in the Thames Valley for the very large quantities of grain and wood sent to London and so there was a very regular passage of boats to and from London. Upstream from Henley, whilst the journey still seems to have been possible for the Penn tilers, the services were infrequent and the distance to Oxford by river was over twice that by road. These factors, together with the delays, costs and risks outlined above, may well have meant that road transport was often preferred for carriage to the west, especially since an extensive network of roads and bridges was well established by 1300.[78] Keen's distribution map for the location of Penn tiles shows only 20 out of 147 places close enough to this upstream section of the Thames to have justified river transport.

The commonest term used for cargo boats on the Thames in the Late Middle Ages was 'shout' (Fig. 4).[79] The best evidence for its dimensions and characteristics comes from the remains of a boat unearthed at Blackfriars, London, in 1970 and referred to as *Blackfriars 3*. It was almost certainly a shout, to which there are numerous references in the fourteenth, fifteenth and early sixteenth centuries. The Blackfriars boat was probably built between 1380 and 1415 and had been in use for 75 years before it sank. There is a scale model of it in the new River and Rowing Museum at Henley.

Blackfriars 3 was long, broad, shallow and flat-bottomed, pear-shaped in plan with the widest part near the stern. It was 48ft long, 14ft wide (10ft flat bottomed) and 3 ft high amidships. It was clinker built of oak with iron rivets, pointed at both ends, carried a 26ft mast with a 12 ft square sail, both of which had to be lowered when passing under a bridge. It was steered by a 'great oar' mounted over the stern, aided perhaps by poles and was designed to carry heavy loads of up to 7. 5 tonnes in shallow waters. A crew of at least two men would have been needed. A single cartload of Penn floor tiles would have occupied only a very small part of the cargo space. Fig 4 shows a typical shout being loaded at a London dock.

[76] Lesley Boatwright (Ed), *Inquests and indictments from late fourteenth century Buckinghamshire*, Buckinghamshire Record Society, **29** (1994), p. 81

[77] R. B. Peberdy, 'Navigation on the River Thames between London and Oxford in the late Middle Ages: A reconsideration', *Oxoniensia*, 61 (1996), 311–40

[78] J. Stopford, 'Modes of production among medieval tilers', *Medieval Archaeology*, **37** (1993), p. 101

[79] Peter Marsden, 'Ships of the Port of London twelfth to seventeenth centuries AD', *English Heritage Archaeological Report 5* (1996), 88–101

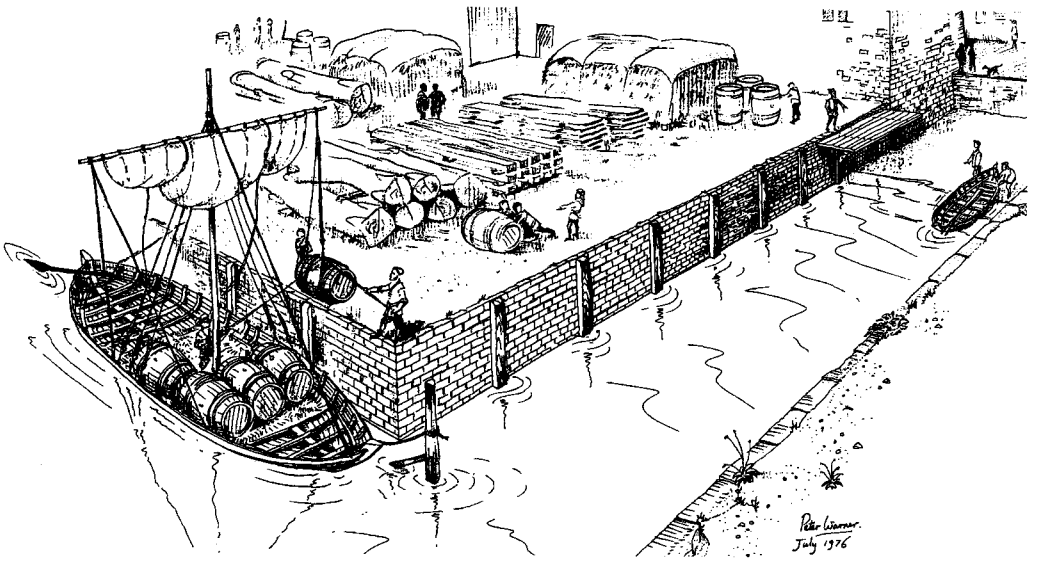


FIGURE 4 Artist's impression showing a shout being loaded at a fourteenth-century dock on the Thames in London. *Peter Warner*, 1976

There are general references to shouts and shoutemen transporting timber, wine corn, hay, dung and 'bricktiles'. There are also two specific references concerning Windsor Castle. In February 1344, a commission was issued to John Knight 'to arrest and take as often as there be need...by the water of Thames between London and Windsor competent shouts for bringing our different estovers from various places'. The following week, another commission was issued to 'arrest on the river Thames between Gravesend and Henley... shouts for stone and other necessities to be purveyed in divers places along the river for the said works'.[80] This was the year that 40,000 roof tiles (probably 80 cartloads) were ordered from Penn for Windsor Castle.

FLOOR LAYOUT, TILE DESIGN, MANUFACTURE & KILN OPERATION

Floor layout

We have seen that floors were generally laid out in patterned bands, often separated by a single row of plain or decorated tiles of a different design. The Aerary floor was made up of nine different designs of decorated tiles, with three mistaken intruders and one plain tile (Fig. 3). This technique largely explains the surprisingly high number of different designs found elsewhere. For instance, an analysis of Hohler's evidence gives the following totals: Hurley Priory (38), St Alban's Abbey (27), Missenden Abbey (21), Hitcham (15), Little Missenden (11), Amersham (8).[81] Even the small medieval chancel at Penn, some 8 feet shorter than it is now, had 7 different tiles[82] (Fig 2e). Pitstone had 51 different designs, but they are a random collection, not arranged in any pattern (Fig. 5).

Description of the tiles

Individual tiles, although very attractive, are not highly artistic. Penn tiles made after the Black Death were mass-produced in a highly efficient commercial operation; they are the product of skilled artisans rather than artists. The designs seem to have

[80] W. H. St John Hope, *op. cit.*, I, p. 113

[81] Christopher Hohler, *op. cit.*, pp. 104–22. These totals were calculated from Hohler's List V of "Printed" tiles probably from Chiltern factories

[82] See fn. 116 & 134 below

FIGURE 5 Tiles in Pitstone Church. Examples of the earliest type of tile from before the Black Death when people could afford individual designs. They vary in size from 4½-5″ square. a) Lion passant (P36). b) Dog pursuing a stag. Designed for diagonal laying (P32). c) Figure standing against a semi-circle (P13). d) Fleur-de-lis with two birds (P40). e) 4-tile design of beasts with fleur-de-lis (P126). *Photographs by Eddie Morton*

been influenced by earlier successful commercial tileries at Danbury in Essex and at an unknown place assumed to be in Hertfordshire.[83] The great majority of Penn tiles are about 4½ inch (11.5cm) square and ¾ inch (18mm) thick, with chamfered edges, the top being wider than the base. They weigh about 1 lb (0.5kg). The clay is usually rich red and hard, often with a dark grey or black core. Typically, the bottom of the tile has a dusting of sand from the forming table during manufacture. The usual decorated and glazed tile is brown with the white slip decoration looking cream under a clear overglaze. Plain tiles can be yellow, brown, green or black. Triangular shapes were used where needed for laying. Examples of mosaic tiles, round, polygonal and octagonal, are discussed in the Local Gazetteer (Appendix 1).

Elizabeth Eames suggests that there were three generations of tilers making stamped, two-colour tiles over 60 years or more and she identifies three slightly different types.[84]

(1) The first, before the Black Death, slightly thicker than the average and mainly of unsymmetrical designs, very well made and neatly decorated (Fig. 6). Designs included: a fool's head surrounded by the legend RICARD ME FECIT (P1); heraldry (P9); a man holding a battle axe (P10); a mounted man with a hawk or falcon (P12); a bird in wavy circle (P22); a hare (P26); a hound (P29); a stag (P34); a lion passant (P36)[85]; the head of a king (E1357); also the only 9-design for Penn tiles noted by Eames (E2870/P173A & E2871/P171 outside, with E2363 in the middle).

(2) The second, and main phase, after the Black Death, included the tiles laid at Windsor in the 1350s and 60s. They were a little thinner and possibly smaller, but also well-made, with repeating single-tile patterns, symmetrical on both diagonals, to give the very practical advantage that it did not matter which way round they were laid. These include the four-tile patterns based on circular bands (Fig. 7).

(3) The third type, made in the 1370s and 80s, tends to be slightly smaller, less well made and rather hard fired, often dark purplish-brown in colour with deep yellow decoration. It would seem that this third generation had lost much of the technical expertise of its predecessors, but nonetheless the resulting pavements were effective and pleasing. This third type was used in Baynard's Castle, in the Bloody Tower and in Kennington Palace (e.g. P145 at Fig. 13c & P161)

The stamping technique

All these three types of decorated tiles discussed were made by impressing the pattern on the soft clay with a carved wooden stamp, probably of beech, that was re-used until it wore out. It was then copied and the copies were copied until the original design was scarcely recognisable. There was no copyright on a design once it was laid and other tilers could and did copy it. This is why there are often small differences between a tile and the recorded design. Haberly estimated that with good tools a typical medieval design can be cut in clean beech in a few hours.

It is not clear what method was employed for applying the white clay or 'slip' used for decorating the two-colour tiles. Hohler concluded that it had been the invention of a new technique for doing this that heralded Penn's period of remarkable pre-eminence. The immediately preceding method had required two separate operations. The red clay tile was first stamped with a wooden pattern and then the resultant hollows were filled in with white pipe clay. Haberly had suggested, and Hohler agreed, that the technique of 'printed' tiles combined these two processes, with the design 'block-printed' using a shallow-cut wooden stamp already smeared with white 'slip' by dipping it into thick liquid white clay. This would have reduced the time and labour involved and hence the price.[86] Haberly thought that this was an easier method than coating the whole tile with white slip, stamping it and scraping the surface clean. He had found

[83] Elizabeth Eames, *Catalogue,* I, pp. 184, 209

[84] *Ibid.*, pp 223–5

[85] Christopher Hohler, *op. cit.*, pp. 104–22, notes where these tiles have been found, mostly from Bucks and Oxon. Those found at or close to Penn are: P1 in Amersham church; P9, a narrow rectangular border tile in Penn Church chancel; P12 in Missenden Abbey, now in Gt Missenden church; P22 at Ashwells, Tylers Green; P34 at Yew Tree cottage, Penn; P36 in Little Missenden

[86] Christopher Hohler, *op. cit.*, p 5.

FIGURE 6 Examples of the more individual Penn tile designs, assumed to be from before the onset of the Black Death in 1348. From Christopher Hohler's 1941 *Records* article and are roughly ¼ scale. *By Bill Bundy*

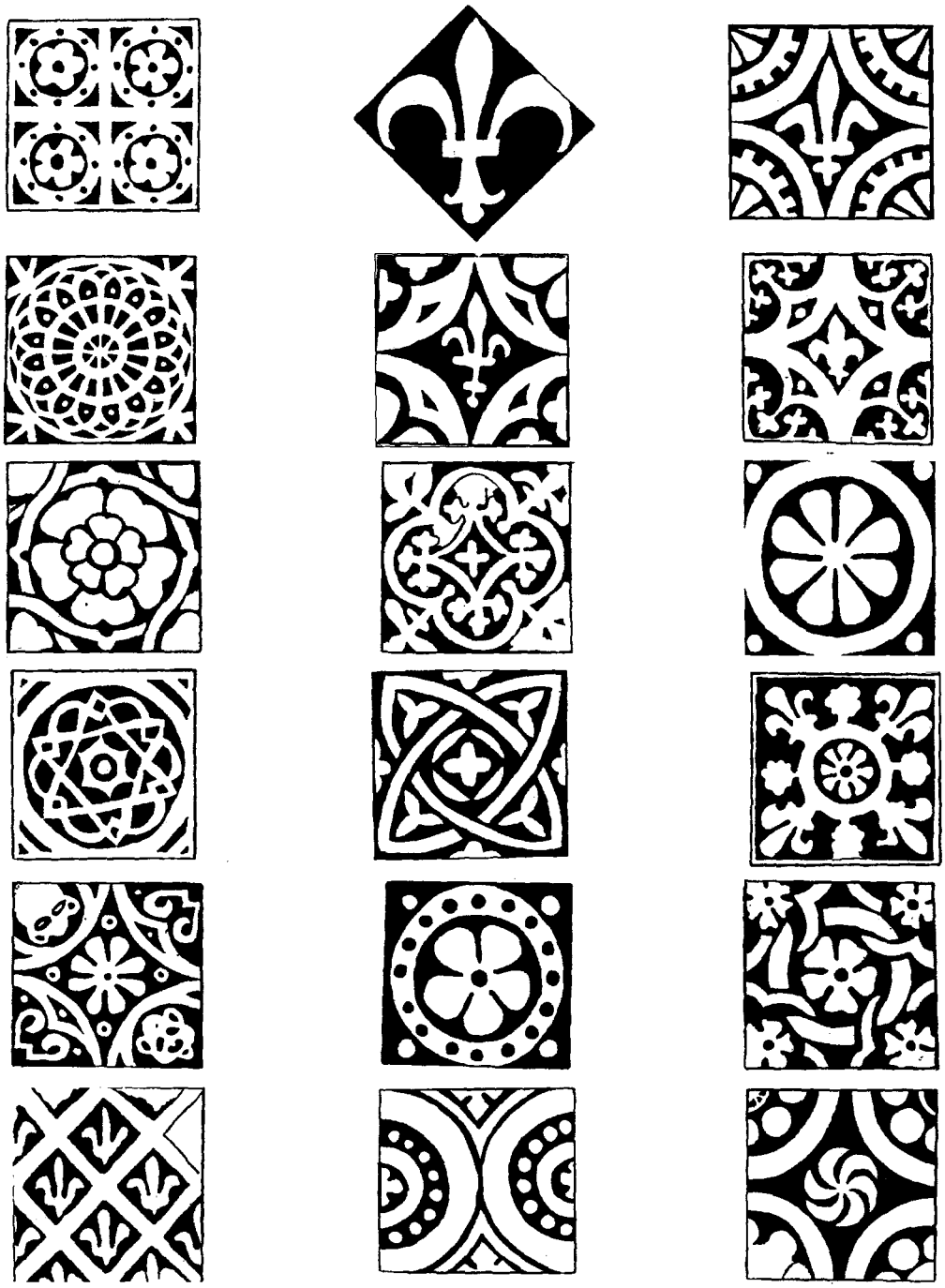


FIGURE 7 Examples of some Penn tile designs assumed to have been mass-produced after the onset of the Black Death in 1348. The drawings are from Christopher Hohler's 1941 *Records* article and are roughly ¼ scale. *By Bill Bundy*

evidence of both methods but mostly of the printed type. [87]

However, Eames thinks that this printing technique would have been difficult, if not impossible, in the medieval period since the white clay would have stuck to the wooden stamp and not printed off on to the tile. She agrees it is possible that they stamped lightly *after* coating the face of the tile with white clay, but more probable that the tile was stamped *before* coating the surface with thick white slip, either by pouring it on or by dipping the tile in it. The surplus slip was cut or struck off the top fairly carefully leaving the white clay in the pattern level with the top of the tile. The use of the very shallow cavity eliminated the danger of the white clay falling out and in fact it made an excellent bond with the tile body. [88]

Manufacture

Work in medieval tileries was seasonal and was carried out only in the frost-free summer months, as frost crumbles unbaked clay and the cold both retards the drying and cripples the moulders' hands. Clay has to be properly weathered or 'tempered' before it can be used. It was dug in the autumn and carted to yards and left in heaps until Christmas, then turned over and left until spring. In 1468, the newly formed tilers' guild laid down strict rules for this process, because tiles were being made so badly that they only lasted three or four years instead of forty or fifty. They stipulated that,

> '*the clay therof shulde be diged and caste at Mighelmasse (29 Sep) and soo lye open to Cristmas thanne next folowing, and thanne to be turned and caste agen wherby the marle and chalke shulde breke out like as chalkestones and cloddes liying in the frost ar woned to doo. And thanne in the March thanne next ensuying therof shulde be made tyles goode and profitable like as it have been of olde tyme.*'[89]

These rules came a century after the Penn tilers, but presumably reflected medieval best practice. The five or six months of rain and frost broke up the clods and washed out some of the stones and debris. Meanwhile, the wood store was replenished, kilns were restored or rebuilt, tools and carts were repaired and new decorated wooden stamps were carved as needed.

A detailed account, for 1370, of one of the roof tileries at Nackholt in the Kentish manor of Wye, shows each of the preparatory processes involved and their annual cost for each kiln:

Cutting wood	15d
Clay 'cast'	14d
Clay 'tempered'	18d
Clay carriage to the kiln	8d
Clay prepared for moulding	14d
Gratuities to the tilers,	12d
Making and baking the tiles	14s

This gives a total annual production cost for each kiln of 20s 9d. There were 13 kilns making a total of about 169,000 tiles, so each kiln made 13,000 tiles in the year, at a cost of 20s 9d. This gives a production cost of about 1s 7d per 1000 tiles at a time when they were sold for about 2s 6d per 1000.[90]

Tiles were formed on long forming tables covered with a dusting of sand, in an open-fronted shed. The clay was prepared for moulding, perhaps by treading or trampling it to the right consistency[91], and stones and any other visible foreign matter were removed by hand. Sand was often added to alter the consistency of the clay. The tile was then shaped, either by rolling out the clay and cutting around a template, or by packing the clay into a 'form', a wooden box without top or bottom, probably made of beech wood bound with iron, in the shape of the tile. Beech was used because, according to a seventeenth century letter, 'the earth will slip easiest from it.'[92]

This is Haberly's description of Dorset yards in the 1930s where floor-tiles were still made by hand:

[87] Loyd Haberly, *op. cit.*, p. 53
[88] Elizabeth Eames, *Catalogue*, I, pp. 47, 221
[89] LF. Salzman, *English industries of the Middle Ages* (1964), p. 176
[90] *Ibid.* pp. 177–8. A second account for 10 kilns making about 100,000 tiles, in 1355, gives the same result - a total annual production cost per kiln of 16s 6d, i.e. 1s 8d per 1000 tiles
[91] *Ibid.* p. 177, n. 5. The word used, *tredando*, is of uncertain meaning
[92] Loyd Haberly, *op. cit.*, p. 47

'The workman stands before a broad table, having upon it a little stout wooden mould like a square cigar-box without top or bottom, a bin filled with dry sand, a short bow bent to a semicircle and strung with a taut wire, a substantial heap of dough-like wet clay, and a pan full of water whereon floats a strike or lath-like stick a little longer than the breadth of the mould. Having well-sanded the table and the inside of his mould, the tile-maker plucks up from his heap of clay a lump rather larger than is needed for one tile and rolls it on the sanded table as a baker rolls a loaf. This roll he flings down with force into his mould, packing the plastic clay firmly into the corners and filling the little box heaping-full. Then with a deft sweep of his taut bowstring across the top of he mould he cuts off the overplus and drops it on the sanded table to be rolled up again in the next loaf. The bowstring leaves the moulded clay flush with the edges of the mould, but scratched and striated by the cutting. The workman smoothes it neatly off with the wet strike, lifts the mould and its contents together and turns the soft tile out on a thin pallet board somewhat larger than the mould. When a long and well-sprung barrow is loaded with these palleted tiles, they are wheeled away and exposed to the air and wind for drying, first flatwise, and then on edge in an ingenious order whereby they support each other'.[93]

The tiles were then left to dry, in a well-ventilated shed or often out doors, until leather-hard. Haberly found that about 24 summer hours were enough. They were then returned to the forming table to be decorated, probably using a round wooded mallet to drive the wooden stamp into the hardening clay, trimmed and bevelled around the edge and allowed more time to dry. They were then glazed and were ready to fire.

Tiles had to be formed about $1/6^{th}$ larger than the finished product to allow for unpredictably uneven shrinkage when drying and firing, and for trimming and bevelling the edges. Most shrinkage took place in the firing, but timing for the drying process was important. Each tile was shrinking and unless caught at the right moment it would be either a little bigger or smaller than the stamp that was cut to the required dimension. There were added complications: Clay from different levels in the same pit might shrink at quite different rates; tile corners dried more quickly because they were more exposed and they therefore hardened and warped and were more resistant to the pattern of the stamp than the softer centre; and the red and white clays shrank unevenly in both the drying and the firing stages.[94]

Glazing

Medieval tilers needed lead for all their glazes, which were usually made by putting lead, probably scrap, into an iron pan and heating and raking it in a furnace until it turned into an ash of lead oxide. This was brushed on to the dried tile and left to combine with the silica and alumina in the clay during firing. The resultant glaze was then an integral part of the tile and did not crackle or flake off. They would have had a problem preventing the heated glazes from running and sticking stacked tiles together.

Contamination from the iron pan and the iron rake, and often from the iron in the clay itself, gave the glaze a yellow colour when over white slip and brown when over a red clay body. Some tilers were able to alter the colour by controlling the amount of oxygen in their kilns during the last stage of firing. More oxygen led to a red body and hence a brown tile under the glaze where there was no white slip. Less oxygen gave a grey 'reduced' body that gave a dull olive-green colour. Alternatively, the addition of copper or brass filings to the lead glaze gave a green colour and adding more gave a black or near-black colour. Adding iron gave a dark purplish brown or black. The colours available were therefore yellow, brown, olive-green, bright and dark green and black, with many pleasing variations of shade within each. These variations were found in products of the same firing and on the same tile when the centre was reduced and the outside was fully oxidised. [95]

[93] *Ibid.*, pp. 44–5
[94] Loyd Haberly, *op. cit.*, pp. 50-2
[95] Elizabeth Eames, *Catalogue*, I, pp. 19–21

The tile kilns[96]

The shape and size of a kiln could have been decided by the shape and type of its wares. A typical medieval floor tile kiln, consisted of a rectangular or roughly-square oven above a firing or furnace area, about 6ft (1. 83m) square internally, heated from beneath by two or more parallel flues or fire boxes which were arched tunnels up to 2 ft (0. 6m) wide and 3 ft (0. 9m) long. The furnace would normally be below ground level to provide insulation and support and was fuelled by wood, typically oak and hornbeam, fed from the stokehole outside the end of the fireboxes. A typical roof tile kiln would have exactly the same arrangements but with a rather longer rectangular furnace and oven, say 7ft 6 ins x 6ft (2.28m x 1.83m).

The furnace was spanned with a series of flat-topped arches spaced five or six inches apart, springing from each side wall to a low central wall. The gaps between the arches allowed the heat to rise up through the oven above. The tiles were stacked on edge on the level top of the arches, one on top of the other in an ingenious succession of tiers at an oblique angle to the one above and below. This arrangement led the fire upward through ever-diminishing apertures and distributed the heat as equally as possible from bottom to top. Sometimes, roof tiles, also on edge, were used to separate glazed tiles. Haberly found that a kiln could not be fired until it was full, because it was the way in which the tiles themselves were stacked that created the flues that drew the fire through the kiln. There does not seem to be a convincing explanation of exactly how some 5,000 floor tiles, with bevelled edges, were stacked, layer upon layer, in a kiln, or of how the temporary kiln roof was supported.

The different parts of the kiln were built of roof tiles stuck together with clay and the oven walls could be up to 4 ft or even 6 ft high above ground level to make room for more tiers in the oven. There was no side entrance to the kiln, so loading and unloading were carried out by climbing over the top of the wall. The top of the oven was temporary and constructed for each firing. It was made of three or more layers of old tiles stuck together with clay, with gaps to allow the heat to rise through the oven. By placing other tiles over these gaps the draught through the furnace and oven, and hence the temperature, could be controlled. The sketch at Fig. 8 is an attempt to show what a complete kiln might have looked like.

Control of the temperature was vital. If it was too low, the tile was under-fired with a soft friable fabric. Over 1,000°C was needed to flux the glaze so that it melted and combined with the clay body, but at 1,100°C the tile bodies themselves would begin to melt if the clay was not carefully chosen, vitrifying and turning purple, hard, brittle and often warped. Even with skilled management there was an unavoidable difference of 200°C between the hottest, bottom front and the coolest, top back of the oven and hence there were always some over-fired and some under-fired waste products to discard after each firing. The tilers had to use their experience to judge the temperature by the colour of the tiles at the top of the oven and in the temporary roof. The smaller the oven, the more control the tilers had over the temperatures throughout it. Glazed roof tiles needed the same high temperatures as floor tiles, but plain roof tiles needed less heat and so could be made in a larger kiln.

The kilns could not be used when it was raining and Eames firmly declares that firing only took place in the frost-free summer months of June, July and August, suggesting that each firing cycle took a week.[97] On *Monday,* the tiles were stacked in the oven, on edge and in tiers, and a temporary roof was constructed. On *Tuesday and Wednesday*, a slow-drying fire was lit, with an oven temperature of less than 200°C, in order to drive out any moisture in the clay tiles that might otherwise expand and burst. On *Thursday*, the temperature was raised to between 1,000 and 1,100°C with a final firing with brushwood faggots to send flames shooting right through the oven to clean the tiles by burning up any bits of ash or dirt on them. The mouths of the fire boxes and apertures in the roof were then closed to prevent an influx of cold air cracking or breaking the tiles whilst they were still too hot. On *Friday and Saturday*, when the kiln had cooled

[96] This section is a composite of Loyd Haberly, *op. cit.*, pp. 55–63 ; Elizabeth Eames, *Catalogue*, I, pp. 30-1 and *English Tilers*, pp. 15–17. J. Stopford, 'The organisation of the medieval tile industry', *Oxford Journal of Archaeology*, 11. 3 (1992), p. 342, points out that there was a wide range of kiln types. Oval kilns; three furnace chambers; five firing tunnels; stoking from both ends – all have been found

[97] Elizabeth Eames, *English Tilers*, p. 17

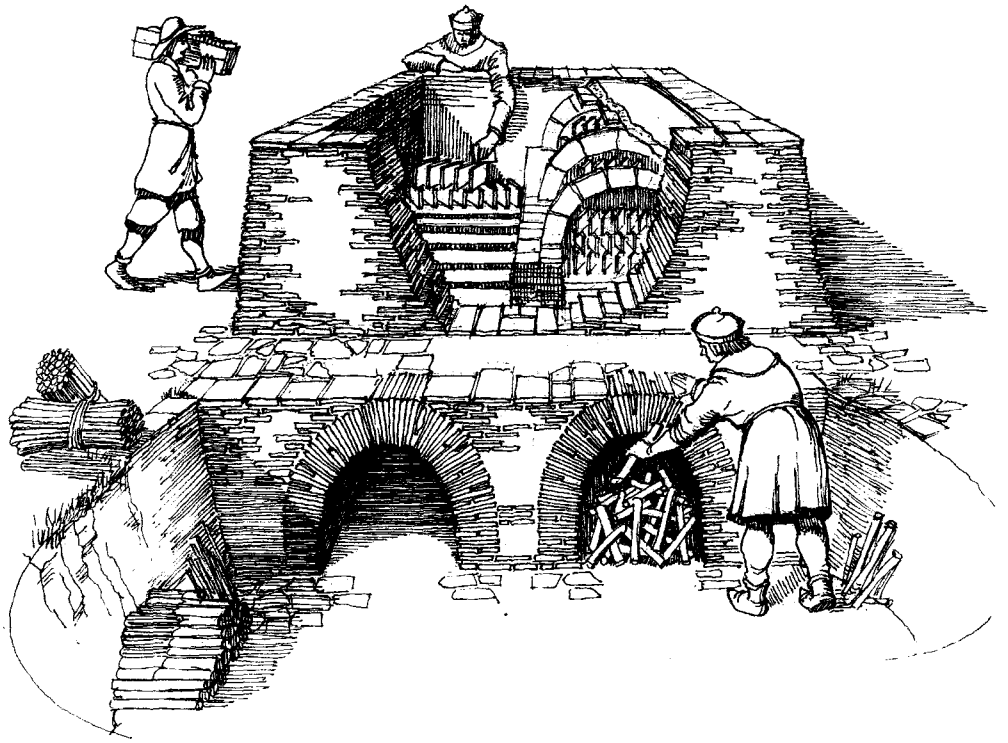


FIGURE 8 Reconstruction of a fourteenth-century kiln with part of the front wall removed to show the inside. Tilers are shown preparing for a firing by putting firewood in one of the two stokeholes, bringing a box of tiles and stacking them in the kiln. *Drawn by Mike Lamont*

down enough, the roof was dismantled and the oven unloaded.

Broken tiles were a surprisingly valuable commodity. There is a reference, in 1354, to the purchase by Windsor Castle, for 4s 6d, of 9 quarters (2¼ cwt) of 'tilsherdes' or broken tile, from Penn, for mending the Windsor lime kilns. In the same year, both tiles and tilesherds were purchased to make two new ovens for the Bakehouse at Windsor Castle, although the supplier was not specified. They were also used in Windsor for wall rubble and for truing up courses of ashlar, the blocks of hewn stone.[98] They can be seen in the walls of Penn church decoratively separating layers of flint. Spoilt tiles, for which there was no useful purpose, were carted away and dumped in disused pits or on fields where we find them today.

Tile makers were thus specialists, particularly those who made the decorated floor tiles. They possessed a store of knowledge about the selection of clays, the techniques of decoration, the making of glazes and the construction and control of kilns to reach a particular temperature.

KILNS IN PENN – NUMBER, DESIGN & LONGEVITY

Penn's geology – The Ordnance Survey's drift geological map shows that 'pebbly *clay* and sand over soft white chalk with many flints' covers the whole of Tylers Green Common. There is also 'mottled clay, sand with pebbles at base', and 'pebbly clay and sand' and clay with flints' on the margins where tiles have been found.

[98] W. H. St John Hope, *op. cit.*, pp. 118, 156 & 152. Haberly, *op. cit.*, p. 70

There is also suitable *chalk* for converting to quicklime to make the mortar for laying the tiles; *wood* for firing the tile and lime kilns; *sand* for mixing with the clay, for putting on the forming tables and for making mortar; and *water* for 'striking' or smoothing the tops of the tiles and for slaking the quicklime. Any suitable place for a tilery would need all these natural ingredients. Penn tilers would have needed to import only the special white clay used for decoration.

The capacity and number of kilns – Haberly's practical experiments showed him that at least 2,000 six inch square (6x6x1ins) tiles were needed to fill his own kiln, which he described as the smallest medieval kiln without giving its exact dimensions. The smallest kiln oven referred to in his book was 6 ft square externally, but since Eames puts the average fourteenth-century kiln oven at 6 ft square internally we will take this as Haberly's kiln.[99] Proportionate to the volumes of the tiles, this would also house about 2,000 roof tiles (10½ x 6¼ x 5/8 ins) or 5,000 4½ inch square Penn tiles (4½ x 4½ x ¾ ins). This can only be a very rough guess because there are major uncertainties about the size of the kiln, both its area and its wall height, as well as the varied mix of products fired in the kiln, which would have included roof furniture such as ridge tiles and corner tiles.[100] Their method of stacking has only been suggested by experiment.

Thus in theory, over the 12 summer weeks, assuming a weekly cycle, each kiln could have produced 12 x 2,000 = 24,000 roof tiles or 12 x 5,000 = 60,000 floor tiles. However, there is contradictory documentary evidence from a tilery at Nackholt, Wye in Kent, which was producing large quantities of roof tiles and roof furniture at the same time as Penn. In 1355, 10 Wye kilns were needed to make about 100,000 tiles over the year and in 1370, seven kilns on one tilery and six kilns on another were needed to make about 170,000 tiles. [101] This gives an annual output from each kiln of 10,000 roof tiles in 1355 and 13,000 roof tiles in 1370, which indicates that the assumptions for Penn that gave an annual kiln production of 24,000 roof tiles need revision. A two-weekly kiln cycle with an unchanged kiln capacity of 2,000 roof tiles or 5,000 floor tiles, would give an annual kiln output of 12,000 roof tiles or 30,000 floor tiles and might be nearer the mark. It would also allow a reasonable time for making the tiles before the firing, for packing them into carts afterwards and for repairing the kiln.

Table 3 shows that 111,500 roof tiles were sold to Salden Manor in 1357. On our revised assumptions of an annual output per kiln of 12,000 roof tiles or 30,000 floor tiles, this would have required nine kilns. The 1357 order for 185,000 floor tiles for Westminster Chapel that we suggested was probably from Penn because Richard Gregory was selling the tiles,[102] would have needed six kilns. This totals 15 kilns all working at the same time throughout the tile-making months in order to meet these vast commissions. We must remember that these calculations only take account of royal orders and leave no margin for wasters due to breakages and the under- and over-firing that were an inevitable part of the process. We should also remember that there were three separate tileries indicated by the 1332 tax return. These estimates seem realistic when compared with the Wye tileworks where we know that two tileries ran a total of up to 13 kilns.

The records of the Wye tileries show a variety of reasons for a drop in output. Shortage of workmen was the principal one, either because of pestilence or because they had been assigned to guard the sea coast against invasion. Other reasons were; heavy rains, repairs to a kiln (a new 'vault' for a kiln cost 7s 4d); and repairs to a tilery building blown down by the wind.[103]

Penn's only examined kilns – Despite several earlier reports from individuals of seeing the remains of a kiln, only very recently have the physical remains of a Penn kiln actually been examined. In 2001, the stokehole and part of a furnace chamber of what was judged to be a seventeenth century brick-built kiln were excavated and recorded (Figs

[99] Loyd Haberly, *op. cit.*, pp. 57, 63

[100] L. F. Salzman, *English industries of the Middle Ages*, pp. 176–7 and Elizabeth Eames, *English Tilers*, p. 16, both refer to an Act of 1477 that defined standard sizes for all these roof tiles – plain, 10½ x 6¼ x ⅝ ins; ridge, 13½ x 6¼ ins; gutter tile, 10½ ins long

[101] L. F. Salzman,, *English Industries in the Middle Ages* (1923), pp. 177–9 and Elizabeth Eames, *Catalogue,* I, pp. 212, 281.

[102] See fn. 67 above

[103] L. F. Salzman, *English industries of the Middle Ages*, pp. 178–9

9a & 9b). The site (T 8 on Fig 1) is in the former garden of Rose Cottage at the side of the main road through Penn next to the entrance to the Penn & Tylers Green Sports Club. It was discovered because planning permission for any development in this area now requires an archaeological survey.

It is very similar indeed to the typical medieval floor tile kiln described above, except that it was made of flat bricks 9 x 4 x 2 ins (220 x 100 x 50mm) rather than of tiles, and the oven was a little longer at just over 7 ft (2. 20m) long and 6 ft wide (1. 8m) internally. The furnace with the oven above was set below ground level, as was usual, and the walls have survived to a height of 4ft 3 ins (1. 3m). The kiln bars forming the floor of the oven were supported about 1 ft 4ins above the floor of the furnace. The oven walls would have been higher but had been deliberately collapsed into the furnace chamber after the kiln had gone out of use. This kiln turned out to be the fifth and latest in a sequence of five kilns on the same site and is referred to hereafter as Kiln 5.

In 2003, further development of the site required more extensive archaeological investigation, which revealed a further four kilns. Kilns 1 & 2 were a pair of tile-built kilns with the later Kiln 2 (Fig. 10a, see on p. 37 below) built on top of an earlier Kiln 1 (Fig. 10b). Their firing chamber was 7ft (2.2m) long by 6ft (1.8m) wide, the same size as Kilns 4 & 5. Kiln 3 was another tile-built kiln, close to Kilns 1 & 2 and at a right angle to them (Fig. 9b). Kilns 4 & 5 were a pair of brick-built kilns, Kiln 5 having been built on top of an earlier Kiln 4. Both used the same hole (which looks as though it was originally dug as a clay pit), as did Kiln 3, for their firing chambers, but had been rebuilt in brick, with their stokeholes at the opposite end. The physical relationship between the five kilns showed that they were not in use at the same time, but that one succeeded the other as it became worn out.

Archaeomagnetic dating did not produce as accurate a date as it can, because of movement of the structures and damage, particularly to the two lower kilns, and so only two sets of readings were possible. They indicated a last firing date for Kiln 2, the second oldest kiln, of 1465 plus or minus 20 years. The archaeomagnetic readings gave Kiln 5, the upper brick-built kiln, a last firing date of 1600 plus or minus 70 years. The size of bricks used supports this age range.

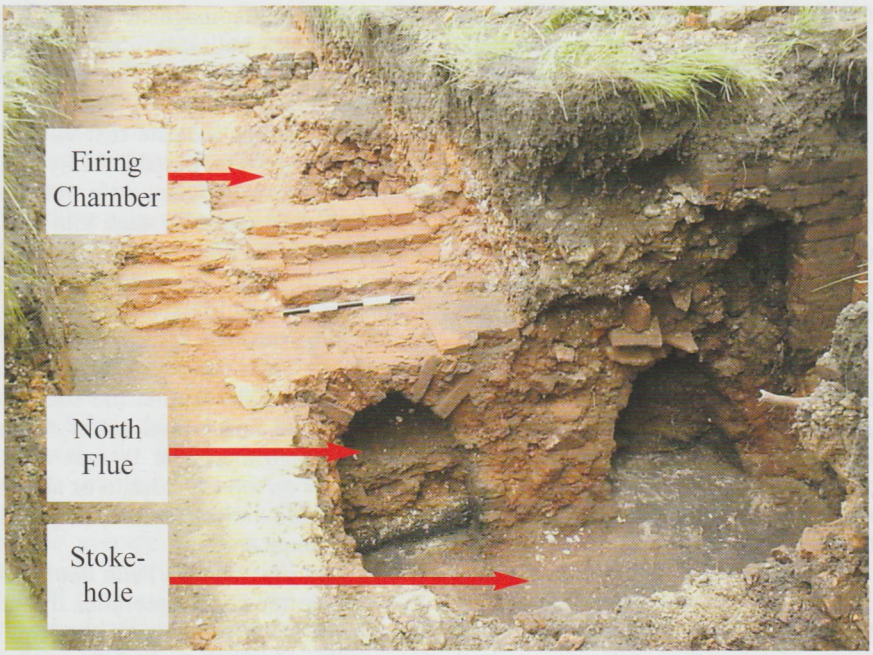
These readings indicate that Kilns 2, 3, 4 & 5 spanned a *maximum* possible 225 years, from 1445 to 1670. This would suggest a maximum average life span of 56 years for each kiln and would take the earliest kiln, Kiln 1, back to the 1380s, at the very end of Penn's recorded floor tile period. The *minimum* average life span for the four kilns indicated by the readings is from 1485 to 1530, i.e., 45 years or 11 years for each kiln. There may well be undiscovered kilns around the site that belong in this sequence and would affect the average life span, although the linear lay-out with succeeding kilns either on top of, close to or abutting its predecessor, could indicate that we may be looking at a complete sequence.

It is also possible that Penn floor tiles continued to be made for some time after the last recorded royal order in 1388 and that Kilns 1& 2 were therefore still making decorated floor tiles, although none were found in those kilns. However, an earlier kiln is indicated by fragments of eleven medieval Penn tiles found in or close to the rubble backfill of the furnace and stokehole of Kiln 5. Some of them were wasters or unfinished, indicating that they may have been made on or close to the site, although they were not found in their original medieval context. Five of the tiles were nearly whole and were recognisably those classified by Hohler or variants of them.

Also recorded on the site were two buildings, assumed to be drying rooms/workshops for the kilns, a beehive oven and another oven feature, both probably related to the tile-making. [104]

Limekilns – In 1332, all three of the Penn tilers had large stocks of lime (11 quarters all told), which they presumably made themselves. The lime was mixed with sand to make the mortar for laying the tiles. They made their own quicklime by burning suitable chalk in special kilns and then slaking the resultant quicklime with water for several weeks, even months. However, the Wind-

[104] Both excavations were carried out by Archaeological Services and Consultancy Ltd. The 2001 work was done by David Fell and reported in *An Archaeological evaluation at Rose Cottage, Tylers Green, Buckinghamshire*, (19 July 2001). The 2003 investigation was carried out by Joe Abrams and reported in J. Abrams, *Rose Cottage, Elm Road, Tylers Green, Buckinghamshire,* Archaeological Services and Consultancy Report PTG/4 (2004). Dr. Jonathan Hunn was closely involved in both.



a)

b)

FIGURE 9 Rose Cottage kilns. a) Kiln 5 viewed from the stokehole. *Photograph courtesy of Archaeological Services and Consultancy Ltd, Milton Keynes.* b) Kiln 5 viewed from the firing chamber is on top of an earlier Kiln 4, both brick-built. The dark area at the top of the photograph is their stokehole. The stokehole and flues of the tile-built Kiln 3, are in the foreground, facing the opposite way. *Photograph by Eddie Morton.*

sor Castle records make it clear that there were limepits and limekilns at Windsor and we noted earlier the purchase of tilesherds from Penn to mend them. [105] The Penn tile layers may well have used the products of these lime kilns when working at Windsor.

The Penn Workforce and the End of Floor-Tile Making

Penn's economy and The Black Death – While few villages escaped unscathed from the Black Death, which first appeared in 1348, some were more affected than others. In Kimble, for instance, in 1349, all the tenants were dead and the land was uncultivated. In the same year, 77 of Buckinghamshire's clergy died. [106] There is no contemporary record for Penn, but the Poll Tax of 1377 suggests that there were only 81 adults in the parish. [107] It is likely that about half the population died in the four successive epidemics.

We have already noted how prosperous the three tilers were in 1332. Tile-making must have been all the more important to Penn's inhabitants since even before the Black Death agricultural conditions were dire. A rapidly increasing population was faced with a climate change bringing cool, wet weather that destroyed harvests and left populations and their animals starving and vulnerable to infection. Loss of cattle to disease and with them the only source of fertiliser for the fields, led to a cycle of reducing crop yields and severe food shortages.

We have a glimpse of these problems from a tax of 1340, which was levied to pay for Edward III's wars with France. Penn was required to pay a total of 20 marks (1 mark = 13s 4d), but the inhabitants claimed on oath that almost one third of the land of the parish, 'which used to be ploughed and sown, lies fresh and uncultivated because many are so poor and impotent that they cannot cultivate their lands'. Their plea was successful and the tax was reduced to 13 marks. [108] The agricultural depression was still a feature of Segrave Manor's accounts in 1372, which report 'for corn much of the land lay uncultivated'. [109] The tower and south aisle of Penn Church, which are dated architecturally to between 1325 and 1350, must have been built before this economic collapse since the money would have to have been raised from parishioners, probably heavily subsidised by the prosperous tilers.

Two of Penn's tilers were in debt around the late 1340s. Walter Baldewyne owed £4 to Richard Gregory junior, the son of the Beaconsfield landowner and lawyer discussed earlier. Robert Jonesone owed £3 to John Otewy of St Albans, a particularly profitable market for Penn tiles. [110] These were significant sums, sufficient to buy 10,000 paving tiles in 1352 or to pay a labourer at 1d per day, for 4 years. Neither name appears in Penn's 1332 tax return and so they would seem to indicate either an expansion of a flourishing tile industry with two new tileries to make a total of five, or replacements for those who had died in the epidemic. The failure to pay the debt may well have been a consequence of the loss of orders in the immediate aftermath of the Black Death.

The more detailed records of the tilers all come after 1348 and so relate to a parish with about 40 working men. We have already suggested that three to five tileries with 15 kilns were needed to meet the royal orders alone, in 1357. If we also consider the many ancillary tasks involved we must conclude that the tile industry entirely dominated the parish, and it is not at all surprising that the tilers gave their name to their part of the parish. The tasks are summarised on the table overleaf.

A paving tile does not wear out quickly and once all the major buildings within reach of Penn had been floored the market would have been saturated. The last record of a royal order for tiles was in 1388, although this does not necessarily mark the end of Penn's floor tile industry. Hohler maintained that all the evidence of design points to the Penn paving tilers eventually having dispersed, taking their own stamps with them. One body of tilers, he said, almost certainly went to Winchester to work for the Hospital of St Cross, where the church is

[105] See fn. 98 above
[106] Michael Reed, *The Buckinghamshire Landscape* (1979), Hodder & Stoughton, London, pp. 145–50. *Victoria County History, Ecclesiatical History*, p. 291
[107] J. G. Jenkins, *A history of the parish of Penn* (1935), p. 59
[108] *Ibid.*, p. 56. A mark was worth 13s 4d or two thirds of £1
[109] *Ibid.*, p. 42
[110] CP 40/383/74. CP 40/392/24. See also fn. 16 above

Tilemakers
Building & repairing the kilns and the forming & drying sheds
Digging & carting the clay
Weathering the clay
Buying & carting white clay for decoration
Carving the wooden stamps
Digging sand for the forming table
Forming the roof, ridge and floor tiles
Decorating the tiles & trimming the edges
Making and painting glazes on the tiles
Loading & unloading the kiln
Control of firing for the week
Sorting & packing tiles on carts
Horse drawn carting
Disposal of unusable wasters by wheelbarrow or cart

Sales team
Looking for new orders
Designing & costing
Arranging manufacture, transport & laying

Woodmen
Cutting coppiced poles for fuel
Making wooden laths for roof tiles

Blacksmith
Roof nails in thousands
Tools – saws, hammers, knives
Maintenance of carts, axles, end plates
Iron-bound forms for tile-making

Lime makers
Building a special kiln
Digging suitable chalk
Burning the chalk in the kiln
Digging sand for mortar

Roof tilers
Fixing laths
Laying tiles

Paviours
Laying the tiles on a mortar bed

still floored almost entirely with medieval tiles all suggesting the work of a Penn tiler.[111] A William Pavyer was a member of a Penn jury in 1479, but there is no indication that he was an active tiler other than his name.[112]

It may well be that the tilers also dispersed more locally, in search of work. John Tylere, particularly described as 'of Beaconsfield' was a juror in 1388, and William Tylere, particularly described as 'of Wycombe' was one of three freelance tilers (*communes tegulatores)* fined for receiving too high a daily rate in 1388 and 1389. A statute in 1388 attempted to hold down wages, driven up by labour shortages as a consequence of the Black Death, to 1d a day for unskilled labourers up to 4d a day for a master mason or carpenter. The tilers had received 3d as well as a midday meal and this was regarded as an overpayment. [113]

There is however documentary evidence that roof tilemaking survived in Penn after the fourteenth century, supplying local needs. For instance, the great barn of Bassetsbury Manor in High Wycombe was repaired in 1411 with 1,000 plain tiles costing 3s 4d per 1000 with 12d for carriage from Penn.[114] In 1512, there is a reference to a 'tyle house lying at tyler-ende' in Penn[115]. The fact that the tiles were worthy of note suggests that ordinary buildings were not tiled, but probably thatched. In 1552, an inventory of goods in Penn Church untypically ends with the statement 'The church is tyled', which probably refers to the medieval floor tiles rather than the roof.[116] The Penn parish register for 1580

[111] Christopher Hohler, *op. cit.*, p. 13
[112] J. G. Jenkins, *op. cit.*, p. 63. Deeds dating from 1654 for an as yet unidentified property called 'Paviours' can be seen in the County Record Office, AR/136/79/1M
[113] Lesley Boatwright (Ed), *Inquests and indictments from late fourteenth century Buckinghamshire*, Bucks Record Society, **29** (1994), pp. 140-1
[114] L. J. Ashford, *The history of the borough of High Wycombe* (1960), p. 56
[115] J. G. Jenkins, *op. cit.*, p. 95 citing BM Additional charters 27403
[116] F. C. Eeles and J. E. Brown (Ed), *The Edwardian inventories for Buckinghamshire 1552,* London (1908), pp. 43–4. The nave tiles were probably removed in the Victorian 'restoration' of 1865 – see fn. 134 below
[117] The name first appears as Pledour in a Plea Roll (CP 40/383/336d) of the late 1340s, and probably derives from a 'Pleader' in a court case, nothing to do with tiles

records the burial of John Playter, a tiler.[117] Physical evidence of the survival of the industry is, of course, provided by the sequence of five kilns found at Rose Cottage, Elm Road, in 2001 and 2003.

Decorated floor tiles were a part of Gothic architecture and used the same motifs as the stonework, glass, and wall paintings. When Gothic architecture went out of fashion at the end of the Middle Ages, the floor tiles naturally followed suit and were replaced by the Renaissance preference for chequered floors of Italian marble or of large plain tiles. Much of the very specialist knowledge was lost and hence the continuing need to experiment to recover some of the lost skills.

The Location of Clay Pits and Kiln Sites in Penn

The geological map shows that all the large clay pits on Tylers Green Common are sited on 'pebbly clay with sand, over soft white chalk with many flints'. East of Beacon Hill, it changes to 'mottled clay; sand with pebbles at base' and the Beacon Hill pit is right on the borderline. The Ashwells pit is just over a border into 'clay with flints'.

Tile-making over so many centuries, together with pottery and later, some brick-making would leave huge clay pits and this is exactly what we find (Fig. 1).[118] There is a particularly large clay pit in the grounds of Rayners School. It backs on to the School Road houses and is about 150 yards from the nearest likely kiln site at T4. It was described as some 200 yards in circumference and 30 feet deep and, in the mid-nineteenth century, the first Sir Philip Rose supposed, that it had been dug by the tilers.[119] There were also half-a-dozen large pits on Tylers Green Common, now much less visible than when it was open common since they are all surrounded either by houses or trees. Two have been largely filled in after use as the village rubbish tip and one has been filled up to make a garden for the former Busby's Nursery. Three are marked as gravel pits on the 1875 map, but were probably dug for clay in the first instance. Both clay and stones are found, often in bands, in immediately surrounding areas.

Kiln wasters and tile fragments have been found in eight places (Fig. 1). We know that millions of floor and roof tiles were made in the fourteenth century and have concluded that, in 1357, three or perhaps five tileries, working on a two-weekly cycle, were operating a total of at least 15 kilns, in order to satisfy royal orders alone. Over the 60 recorded years of the Penn floor tile industry, kilns would have been repaired many times *in situ* as well as built anew nearby and perhaps further afield as new clay pits were dug. However, no medieval kiln site from this recorded period has yet been confirmed by archaeological investigation, unless the Rose Cottage sequence could just reach back to the very end of the period. Elsewhere, the evidence has all been from second-hand reports of sightings and from kiln wasters. The sketch map shows all the sites where tiles have been found.

Each of the tileries would have had several kilns as well as a workshop shed, a drying shed and stores for wood fuel and possibly clay. There may also have been accommodation of some kind for the non-local, seasonal employees. It seems probable that all the kiln sites were on the edge of the common and are now largely covered by the houses lining Elm Road from above Potters Cross to Beacon Hill. The remaining open common facing these houses has numerous depressions which seem to be evidence of trial clay pits that went no further. The deeds of three of these Elm Road houses, built on land sold for building by the Penn Estate in the 1920s and 1930s[120], all contain the following provision, '*The said land is not at any time to be used for the purpose of making or burning bricks tiles or other wares or for the excavation of ballast or gravel nor ... to be used in any way that might be an injury nuisance annoyance or inconvenience to the Vendor or his tenants or the occupier of any adjoining or neighboring properties.*' It is tempting to take this as evidence of the long continuation of kiln sites in the immediate area, but the inclusion of this provision in conveyances seems to have been a more general policy of the Penn Estate at the time.

Tilers were not regarded as good neighbours because their work was dirty and smelly. Wet clay

[118] Mrs Violet Becher's *History of St Margaret's Church* , published privately , Tylers Green (1937), records that there had been a brick kiln at the corner of Hammersley Lane before the church was built in 1854. The kiln is also referred to in an 1803 deed of a property opposite the church

[119] *Bucks Herald*, an undated cutting of Aug or Sep 1916. It is not nearly so deep now having been used as a dump for many years

[120] Merchants Yard (1924), The Elms (1931), Pond House (1939)

sticks to everything and the smoke and noisome fumes from their kilns were best sited as far from houses as possible. They had a correspondingly low social status and, in 1461, the tilers of London were declared to be mere labourers and forbidden to form a gild. However, only seven years later, 'the good men of the mistery of tilers' successfully petitioned for their restoration to the status of a craft on the grounds that roof tiles were being made so badly that they only lasted three or four years instead of forty or fifty.[121]

The fragments and wasters found on the outlying fields at Puttenham Farm (T6) and at Ashwells (T5) are likely to have been dumped there to get them out of the way – normal practice to keep the working area around the kiln clear.[122] The 1340 tax return reported that one third of the fields were not cultivated and it would have been a good deal worse after the onset of Black Death in 1348. There would have been no difficulty in finding a convenient spot. The Puttenham finds were only 100m from roadside kiln sites and the clay pit at Ashwells may have been the reason for carting tile debris so comparatively far.

There have been suggestions that not all Penn tiles were made in Penn kilns, but were manufactured by Penn tilers using their own stamps, from clay sources and kilns local to the customer.[123] Whilst this itinerant model has been found elsewhere,[124] it is not so far supported by any archaeological or documentary evidence, all of which continues to point firmly to Penn. The predominant distribution pattern of the locations where tiles have been found shows a marked cluster around Penn and along the Thames. This is characteristic of a settled tilery not an itinerant one. Stanley Cauvain's 'chemical fingerprints', which readily distinguish between different production centres, confirmed a Penn origin for the one Windsor Castle tile tested, and could eventually settle the matter

The vast majority of tile finds have come from three gardens (see Appendix 1), Grass Side, Cobblers and Yew Tree Cottage, all of which back on to the same large clay pit at the end of Beacon Hill (T3 on Fig. 1). Two other reported kiln sites (T1 & T2) are close by, and it is also noteworthy that Slades Garage, which was formerly a smithy, is adjacent. The record shows that there has been a blacksmith on the same site since the eighteenth century and it could well be that fourteenth-century blacksmiths were working there making lath nails and iron-bound forms for the tilers, shoeing their horses and repairing their carts.[125]

Chemical analysis of the tiles and other ceramics has not yet been able to distinguish between different clay sources in the same production area and so we have to rely on tile designs for clues about where particular tiles were made. This may seem a hopeless cause but the table below is surprisingly informative:

This is only a snapshot, but it does suggests that a Beacon Hill kiln was the source of most, if not all the tiles used on the first three sites and that this area was the main focus of the tile industry, at least in the 1350s when the Aerary floor was laid. The finds at Beacon Hill of the earlier designs – the St Alban's type tile and the 6 inch square tile (Fig. 2a) – also show that tiles were being made there before the Black Death. Only four out of 14 designs found at Stratfords Cottage match those from Beacon Hill

Site where tiles were found	*Total no. of designs found*	*Same designs at T3, Beacon Hill gardens*	*Same designs at T2, Stratfords Cottage*
Penn Church chancel	7	5	1
Aerary, Windsor Castle	10	8	1
Amersham Church	3	3	0
Missenden Abbey	6	3	2
St Albans	8	3	5

[121] L. F. Salzman, *English Industries in the Middle Ages*, *op. cit.*, p. 175. Elizabeth Eames, *English tilers, op. cit.*, p. 10. See also fn. 89 and text
[122] Elizabeth Eames, *Catalogue*, I, pp. 30-1
[123] Stanley Cauvain, *op. cit.*, p. 151
[124] J Stopford, 'Modes of production among medieval tilers', *Medieval Archaeology*, **37** (1993), p. 97
[125] Miles Green, 'Slades Garage', *Penn & Tylers Green, Village Voice*, 45 (1994), p. 7

and this suggests different tileries with different markets, though with some overlap of popular designs as might be expected.

Accepted Reasons for Penn's Success

Laurence Keen's recent paper concluded that the Penn floor tile industry stood out as the most extensive, successful and well-organized commercial tile workshop in medieval Britain. While the reasons he and others have advanced to explain this remarkable success are all entirely valid, they do not sufficiently explain its unexpected size and scope – why it is that this particular, modest rural parish should have been able to achieve such a remarkable dominance of the market for two or three generations, with three to five tileries and 15 or more kilns operating at the same time in busy periods? It is hoped that this study, written very much from a Penn perspective, has been able to throw more light on the mystery. The explanations suggested by previous research are as follows:

(a) **Quality, technique, size and design** – Eames describes the tiles as not highly artistic, but a good product, technically very sound, quite well prepared and well fired. She concludes that the fact that the Royal Clerks of Works used Penn tiles almost exclusively in the south-east for five or six decades speaks for the quality of these products.[126] She points out that Penn tilers were already well established and, as revealed by the 1332 tax return, were prosperous, commercial tilers before the first wave of the Black Death in 1348, which many of them appear to have survived. They were therefore able to exploit the accelerating change to the use of cheaper, mass-produced tiles created by a market with a lack of craftsmen and high labour costs. It was a time when even the king could no longer afford the specially commissioned tiles of earlier centuries.

Eames does not agree with Hohler, who followed Haberly in concluding that Penn tilers had achieved a significant advance over their rivals by the invention of a new two-in-one printing technique, because she thinks that this technique would have been difficult, if not impossible, in the medieval period. Instead she emphasises the importance of the size of the tiles. They were significantly smaller than most that had been made previously. This meant that the tilers could make more from one cartload of clay, fire more at one loading of the oven, use less of the expensive white clay for decoration, and get more of the finished tiles into one cart. As they sold their tiles at a price per thousand, their product was more profitable. In fact, in their efforts to save on materials for the third and last phase of production, they made their tiles rather too thin for their surface area and, as a result, many of the tiles were slightly dished and so wore at the corners.

Eames emphasises that these were mass-produced tiles made as a speculative venture and stressed how important it was that the tiles were designed to be easy to lay by a tiler unfamiliar with them. They were of a convenient size to handle, not too large and not too small, and, by the second and third stages of production, most of the single-tile designs were symmetrical on both axes and so it did not matter which way round they were laid. The four-tile patterns were based on circular bands that make it clear how they should be laid. Both devices made the paviour's work easier and quicker, and the tiles could be laid, without special instruction, in a decorative design to make an effective floor.

Laurence Keen also concluded, from his close study of the various surviving floors, that a major part in the success of Penn tiles was that they were particularly well designed for laying attractive pavements with very little difficulty in arranging them in narrow, longitudinal panels, following the axes of the room.

(b) **Road and river transport** – Penn's advantage in being only a mile and a half from the main London-Oxford road, 13 miles by road to the all-important royal patron at Windsor, and six miles to the Thames at Hedsor has already been discussed. Hohler noted that tiles had been supplied to most places within reach of Penn by road or along the navigable parts of the Thames and Keen's distribution map demonstrates this very clearly.

[126] Elizabeth Eames, *Catalogue*, I, pp. 221, 225 and *English Tilers* , pp. 9, 57

Further Reasons for Penn's Success

Additional explanations for the remarkable success of Penn's tile industry that have arisen from this study are as follows:

(a) **Established skills of manufacture and laying** The mosaic tiles discovered in the Penn church graves (see Appendix 1, 1967) – the hand-incised roundel and octagonal centrepieces (Figs 11a & b, see on), the pentagonal surround tile for an octagonal centre (Figs 11c & 12a) and the stabbing holes found in some of the plain green and yellow tiles, all confirm an active generation of tilers in the first half of the fourteenth century when more laborious and expensive techniques were still affordable and in fashion. The Beacon Hill gardens have provided similar evidence in the form of an outer part of a 9-tile mosaic with a square centre (Figs 11d & 12d), a six inch square, deeply impressed tile with a unique design of a king's face (Fig. 2a), and a St Alban's style sharp-edged lion's mask design. Stratford's Cottage and the Puttenham fields both provided parts of 9-tile mosaics. Hohler noted only four 9-tile designs, probably because they must have been very difficult to make. They required three different tile designs all drawn at the same time in order to match accurately (Fig. 12c). Details of all these finds are given in the Local Gazeteer at Appendix 1.

These finds confirm that the Penn tilers had the necessary experience and the skills and so were able to get off to a quick start after the first epidemic of the Black Death when the summons came for tiles and tilers for Westminster Palace and the Tower, in May 1350. However, Tables 1 and 2 show that they were only able to charge high prices for a year or two. Thereafter, the prices of tiles and charges for laying tumbled sharply, presumably a result of growing competition or reduced demand, and by 1354, the price of tiles was little more than half its 1351 level. The fact that they were able to achieve this reduction in price demonstrates a very high level of efficiency and skill throughout their whole operation, from raw clay to the safe delivery of the finished product. After the advantage of the initial two or three years to develop their systems, it would have been difficult for rivals to catch up.

They were equally skilled in the laying of the tiles. This study has established that it was Penn tilers as well as tiles that were summoned to Westminster in 1350. It is also clear that Elie and his mates at Windsor were Penn tilers and the combination of easily laid tiles making an attractive design, with the practised skill and speed of laying that they acquired, must have been hard to match. There cannot have been many tilers able to lay 400 tiles a day, six days a week, throughout the year, and able to drop from a fixed rate of 20d to 12d per 1,000 tiles in order to get the contract.

(b) **Free raw materials** – All the natural ingredients required for making and laying tiles were readily available, in generous quantity. What is more, most of them were probably free because 'liberty to dig chalk and clay, sand and mold, and to cut bushes and maple, hazle, sallow, willow and crab and no other wood', were claimed as traditional rights of common on Wycombe Heath, of which Tylers Green Common was a part.[127]

It is likely that the Beacon Hill clay pit was then on the common which continued down Beacon Hill in a wide band, still 100 yards wide in places before the mid-nineteenth century enclosures. The only running water in that part of Penn was close at hand, at Stumpwell, which remained the only unfailing water supply for the village until the mains arrived in the 1920s.

Experimental work has shown that the successful firing of kilns depends on a supply of small dry wood that will burn quickly producing a high temperature. It is one of the products of coppice woodland which was harvested at regular intervals every seven years or so.[128] There was plenty of this kind of wood available to the tilers. The accounts for Segraves Manor, in 1372, have frequent entries for the sale of 'tallwoods', the shoots from coppiced or pollarded trees. They were the most valuable crop of this small manor, costing nothing if made by the manorial servants and 6d per 100 otherwise. They were sold at 1s 6d per 100. In 1372, 1,000 were hauled by horse to the

[127] John Chenevix Trench and Miles Green, 'Wycombe Heath and its 'Charter', *Records of Buckinghamshire*, **36** (1994), p. 149. This definition of common rights was given to a Commission of Inquiry in 1666 by George Long of Penn, gent, who owned Puttenham Place.

[128] J. Stopford, *op. cit.*, p. 100

a)

b)

c)

FIGURE 10 Rose Cottage kilns. a) The firing chamber of Kiln 2. The stokehole is under the tarmac track at the foot of the picture. b) Kiln 1, the earliest kiln, beneath Kiln 2. *Photographs courtesy of Archaeological Services and Consultancy Ltd, Milton Keynes.* c) Part of the new floor of the altar platform in Penn's Lady Chapel. The edge of the centre-piece of newly-made tiles of a typical Penn four-tile design, can be seen to the left. *Photograph by Eddie Morton*

Thames for London and another 700 were sold locally to unnamed buyers.[129] Segraves Manor held 100 acres of wood on Wycombe Heath and Penn Manor a good deal more.[130] Tallwood from the Heath was not a common right, it belonged to the lord of the manor.

(c) **Importance of roof tiles and pottery**– The importance of roof tiles to the Penn tileworks has not been sufficiently emphasized. We saw from Table 2 that nearly twice as many roof tiles as floor tiles were sold over the same period and that the price of the overall sales package of plain tiles, ridge tiles and laths, pegs and nails, was only a little less than for the equivalent quantity of floor tiles. We saw that Robert Tillare sold both floor and roof tiles to Windsor Castle and note that roof tiles have been found in Penn wherever there are floor tiles. The shorter life and constant demand for roof tiles would have made it a more reliable market and one that could sustain the more uncertain decorated tile market through lean times. For instance, Segrave Manor, in 1372, employed a tiler and his assistant for three days, at 4d and 2d per day respectively, to roof a big granary.[131]

It was probably the skills of glazing, decorating and firing elaborate ridge tiles that laid the base for the later development of the decorated tilers. The Penn roof tilers were not poor relations. They used the same kilns for roof and floor tiles and roof tilers were to survive long after the floor tilers had moved on. We should note that large quantities of roof tiles were sold at a steady price, apparently without the benefit of any particular manufacturing technique, and this suggests that both workmanship and price must have been unusually excellent. They were charging only half the 5s per 1,000 limit set by the City of London in 1350.

Pottery production was also significant. Fourteenth century pottery in considerable quantity was found with the tiles at Ashwells (T5) and suggested the concept, new for Penn, of joint pottery and tile production in the same kiln, though not at the same time. John le Pottere appears in the record in c. 1349 as a companion of William Tylere. Potters Cross was already so called by the mid eighteenth century. It was a characteristic of settled medieval tileries that they produced a range of ceramics with floor and roof tiles frequently combined with pottery.[132] Decorated tiles have received more attention because they are so much more easily identified and dated.

(d) **Rich and well-connected backers** – The importance of Royal patronage has long been accepted as a crucial factor in the overall success of Penn tiles. Royal sales are first recorded with the sale of roof tiles to Windsor Castle in 1344, well before the Black Death. The de la Penne and de Mohun families may well have had influence at Court, but the discovery that John Alkeshull, named in connection with the first order for decorated tiles in 1350, was from neighbouring Beaconsfield and was the King's purveyor of building materials and labour, from the 1320s to 1364, is highly significant.

Equally significant is the discovery that Richard Gregory, another of the three men required to find tilers and tiles for Westminster Palace and the Tower in 1350, was a wealthy Beaconsfield landowner with close connections with Penn, the royal court and the City of London, and that his son had lent money to one of the Penn tilers. Eames pointed out that the tilers must have been very well organized to deal with such large and important orders and distribute tiles in their countless thousands all over the Chilterns and the Middle Thames. Keen suggested that it was middlemen in London who arranged the detail of deliveries and transport.[133]

It is now clear that behind highly experienced and skilful floor tilers working on their well-designed tiles, in an ideally placed parish, with unlimited, cheap natural resources, backed by a successful roof tile market and some pottery production, there was a wealthy, educated, well-con-

[129] J. G. Jenkins, *A history of the parish of Penn* (1935), pp. 34–52

[130] There is an almost continuous run of Court Rolls for Penn manor from 1334, which have not yet seen the light of day

[131] J. G. Jenkins, *op. cit.*, pp. 41, 49. The manor also bought 3,000 tile pins and 1,600 lath nails, 100lb of 'spykynge' nails, 2 qr of lime and 123 specialist tiles for gutters, drains and roofing angles. Presumably they were reusing the existing plain tiles

[132] J. Stopford, *op. cit.*, p. 103. Michael Farley & Jo Lawson, 'A fifteenth-century pottery and tile kiln at Leyhill, Latimer, Buckinghamshire', *Records of Buckinghamshire*, **32** (1990), pp. 35–62, records a pottery kiln constructed within a disused roof-tile kiln with little interval between the two episodes of use.

[133] Laurence Keen, *op. cit.*, pp. 226–7

nected and well-organised management team with close links to the royal court. It was this unusually favourable combination of factors that explains the widespread sale and distribution of the floor tiles and their remarkable dominance of the market for so many years.

APPENDIX 1
LOCAL GAZETTEER

There has been a steady succession of recorded finds in Penn since 1918, all of which have added something to our knowledge and understanding of this remarkably successful medieval industry. Reports of these developments are not readily accessible because they are scattered over eighty five years, many, but not all of them in *Records of Buckinghamshire*, and some have never been recorded before. A chronological summary of them is given below and their locations are shown on the sketch map at Fig 1.

1918 *Penn Church* – The parish register notes that, in 1918, Lord Howe retiled the chancel floor in marble. Hohler recorded that tiles out of Penn Church had strayed into the Hertfordshire County museum at St Albans and he drew the seven different designs that he saw there (Fig. 2e).[134]

1907–33 Winter's Garage forecourt, Church Road (T1) – Fragments of both roof and paving tiles have been found in various gardens and nearby fields at the Tylers Green end of Penn for many years. In 1907, a house called Alandale (now Hampdens) was built on what was then an open field at the side of Church Road, opposite the end of Beacon Hill. It was owned by Mr Walter Evans, the local blacksmith. What is now the forecourt of Winter's Garage became his kitchen garden and he frequently found tiles when digging it. He also found what he thought was the entrance to an underground passage leading to Penn Church, which, in retrospect, must have been the flue of a kiln. When the garden was sold to Mr Walter Carden for a garage, in 1933, petrol tanks were dug by spade (the pumps were removed a few years ago), and half a dozen whole tiles were found and many fragments.[135]

1939 Stratfords Cottage, Church Road (T2) – A presumed kiln site was found in 1939 when digging a cess pit in the front garden of Stratford's Cottage, next to what is now Winter's Garage, opposite Beacon Hill. It was investigated by J. G. Jenkins, Clive Rouse and Miss M. Whitely, who found a concentration of tiles, wasters and debris from a kiln at a depth of 1½ to 3 ft, but without any intelligible stratification.[136] The onset of war permitted only a very limited examination and it is not clear that there was any specific evidence of the kiln itself other than the tiles and wasters. A cache of 14 perfect floor tiles, all different, thought to be a trade sample, was found as well as fragments of plain black, brown and yellow floor tiles and a preponderance of roof tiles.[137] One of the decorated tiles (P117) was part of a 9-tile mosaic with a roundel in the centre, described by Hohler as unique (Fig. 12b). The County Museum at Aylesbury has most of these tiles and the Museum of London records show a purchase of about 8 tiles and a waster from the kiln site in 1938, but they cannot now identify the particular tiles.[138]

1941 Christopher Hohler – By the time Hohler came to write his comprehensive summary of medieval paving tiles in Buckinghamshire, he

[134] John Chenevix Trench (Ed), *Penn Parish Register*, 2 ,Vicars' Notes, p. 184. Christopher Hohler, *op. cit.*, pp. 7, 105–119. The chancel tiles, which are now in the Verulamium Museum, were P9 (heraldic), P44, P60a, P67, P68, P88, P153. John Broadbent did an architectural survey of the church in 1947 and noted that the nave floor had been stripped of tiles during the nineteenth century and been replaced by a timber floor between the pews (*Records of Bucks*, **15** (1951–2), Pt 5, p. 317)

[135] Mr Walter Carden remembers it well, as does Mr Geoffrey Perfect, grandson of Mr Walter Evans. Both had one of the tiles and Geoffrey Perfect's tile was P100 (see Fig. 7, centre row, fourth down, of which many examples have been found in the Beacon Hill gardens opposite (T3) and on the Aerary floor. Other tiles were given to the late Mr A. C. Hills, then of Sinclairs, Sandpits Lane

[136] E. Clive Rouse & John D. Broadbent, 'Further discoveries of tile fragments and wasters in connection with Fourteenth century paving-tile and roof-tile kilns at Penn', *Records of Buckinghamshire*, **15** (1951–2), pt. 5, pp. 314 –8. Hohler, writing within a year or two of the discovery, records the following 14 designs as found at the 'Penn kiln site': P50, 51, 58, 64, 66, 68, 74, 76, 110, 117 (mosaic), 124, 137, 141, 145

[137] J. D. Broadbent, 'A second Penn tile kiln site' *Records of Buckinghamshire*, **23** (1981), Notes, pp. 128–9

[138] Christopher Hohler, *op. cit,*. p. 16. A letter dated 7 Jun 2001 from John Clark, Curator (Medieval) for Early London History and Collections, Museum of London explains that war time moves have disrupted their records

FIGURE 11 Parts of early mosaic tiles a) roundel, b) octagon, and c) pentagon, all found in graves at Penn Church and now set in the altar platform of the Lady Chapel. d) Part of a 9-tile design found at Yew Tree Cottage, Penn. *Photographs by Eddie Morton*

noted that he had included a sizeable corpus of indisputable Penn designs, all printed, and drawn from three sources: the floor of the Aerary in Windsor Castle; those taken out of Penn Church, then in the Hertfordshire County Museum, St Albans; and tiles from various Penn gardens which had been sent to the London Museum and County Museum at Aylesbury.[139]

1947–50 Cobblers & Grass-Side (T3) – John Broadbent reported extensive finds of tiles from both his garden at Cobblers and his neighbour's at Grass-Side. Both houses are almost opposite Winter's garage and back on to the same, very large, former clay pit. Some new designs were found, in particular, plain yellow, brown and green tiles and a St Alban's type tile, one inch thick with a sharp-edged design of a lion's mask flanked by fleur-de-lys, depressed slightly below the surface of the tile. Wasters abounded, but no actual kiln site was found, nor any hand tools or moulds. Elizabeth Eames of the British Museum visited and catalogued the finds.[140] More were found in the next 40 years and some were given to the Open Air Museum at Newlands in Chalfont St Giles.

1967 Mosaic tiles in Penn church grave – the Vicar of Penn, The Rev. Oscar Muspratt, found tiles lining two graves just outside the door to the north porch of the church, but there was only time for a quick examination of one grave and half of the other. He sent 19 tiles to Elizabeth Eames at the British Museum, who was particularly impressed by two of the floor tiles that are now in Penn's Lady Chapel, because they are totally different from all other Penn tiles. They seem to have been made by the method which preceded the use of any stamp, that of incising as a freehand drawing, since lines cross each other beyond the point where they should end. Both are the central parts of a mosaic and are the first evidence of this earlier mosaic technique to be found in Penn. The presence of both types together in the grave suggests that both techniques were being used at the same time or had at least overlapped. The much more laborious manufacture of mosaic shapes was finally abandoned after the Black Death in favour of the simpler and cheaper square tiles.

One of the tile fragments is about a quarter of a **roundel**, originally about 8½ ins (225mm) in diameter, and is decorated with the outlined figure of a pilgrim with staff and satchel with a border inscribed . . M SEMPER A. . . (Fig. 11a). The other is a lion's face in profile on an **octagonal** tile about 6½ inches (160mm) across (Fig. 11b). Both had been coated with white slip and the incised decoration appeared as brown lines on yellow. Both seem to have been wasters as a result of breakage. Their fabric is comparable with that of the usual Penn tiles.[141]

There were a further 17 tiles, of which 5 were plain green glazed and three were plain yellow. The presence of stabbing holes on the base of three of the plain green tiles was unusual for Penn but typical of an earlier 'Stabbed Wessex series', which Elizabeth Eames had thought might have been the work of an itinerant band of tilers. There were eight decorated fragments, in seven different designs, of which five have not been found elsewhere in Penn and only one is of a design known to have been laid in Penn church itself.[142]

Following the retirement of the Rev, Oscar Muspratt, a further 32 floor tile fragments were found in the vicarage, wrapped up in 1967 newspaper. He later thought that they must have come from the graves outside the north porch door, in addition to those he had sent to the British Museum. There was one unrecorded tile of particular interest. It was a complete **pentagonal** tile with a fabric apparently similar to the other tiles in the grave (Fig. 11c). It was decorated with the crudely drawn head of a lion or mythical beast that appears to have been part of a 9-tile mosaic requiring a large octagonal tile at its centre (Fig. 12a). This octagonal tile would have had a side of about 2⅔ inches (72mm), much the same size as the incised example with a

[139] Christopher Hohler, *op. cit.*, p. 7

[140] E. Clive Rouse & John D. Broadbent, 'Further discoveries of tile fragments and wasters in connexion with fourteenth-century paving-tile and roof-tile kilns at Penn', *Records of Buckinghamshire*, **15** (1951–2), Pt 5, pp. 314–8. Designs found were P 50, 62, 68, 88, 89, 101, 104, 144, 152/3, 158. The St Alban's type tile is sketched

[141] Conversation and correspondence with the Rev Oscar Muspratt. Elizabeth Eames, *Catalogue*, I, p. 89. The tiles were returned on request in 2001 and are included in the mosaic of Penn tiles now in the Lady Chapel

[142] Pauline and Stanley Cauvain, 'New discoveries of Penn tiles', *Records of Buckinghamshire*, **33** (1991), pp. 44 –8. Elizabeth Eames, *Catalogue*, I, pp. 19, 203–5. The designs were: E2037; P42, 60a, 64, 71, 107, 123

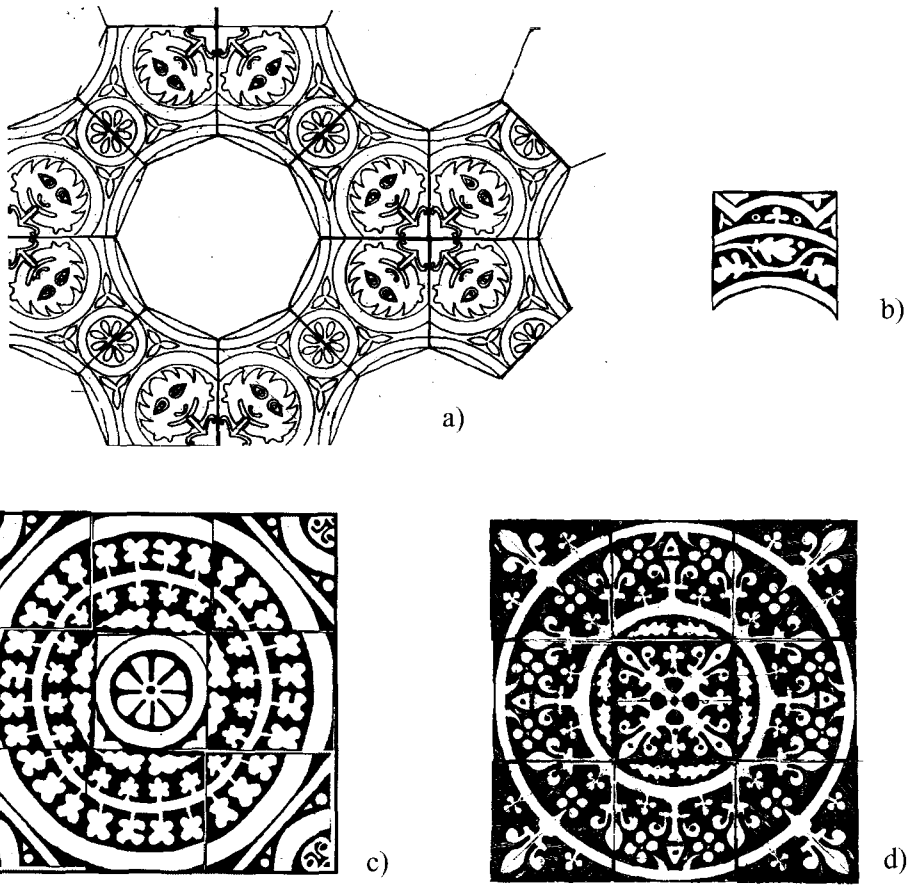


FIGURE 12. 9-tile designs. a) Pentagonal tile (Fig. 11c) making up a mosaic requiring a large octagonal centre of unknown design. *Drawn by Mike Lamont to a design by Stanley Cauvain.* b) Hohler recorded only one tile requiring a circular centre found at Stratfords Cottage (P117) *by Bill Bundy* c) One of Hohler's proposed designs (P171 A & B). Badly fitting because the two tiles were not made as a set. Centre tile is a guess. *Computer representation, Bill Bundy* d) The outside centre tile (Fig. 11d) and centre tile were found at Yew Tree Cottage. Corner tiles are an inspired guess. Just over 1ft square. *Drawn by Mike Lamont, amending computer design by David Bundy*

lion's face discussed above, although these two particular tiles are not contemporary.

Apart from the pentagonal tile, there were varying numbers of seven known designs. Altogether, 23 out of the 32 pieces had matching designs with the earlier British Museum collection from the grave, but there was only one shared design with the tiles that used to be in the church itself.[143] The largest Penn tile (5½ inches square) recorded by Hohler has a cross paté decoration (Fig. 13a) similar to the twelfth century consecration crosses in Penn church (Fig. 13b), but has not been found in Penn.

[143] Pauline and Stanley Cauvain, 'Penn tiles from Penn Church, Buckinghamshire', *Records of Buckinghamshire*, **42** (2002), pp. 15–18. The designs were: E1398, 2037; P64, 71, 75, 93/4, 107,

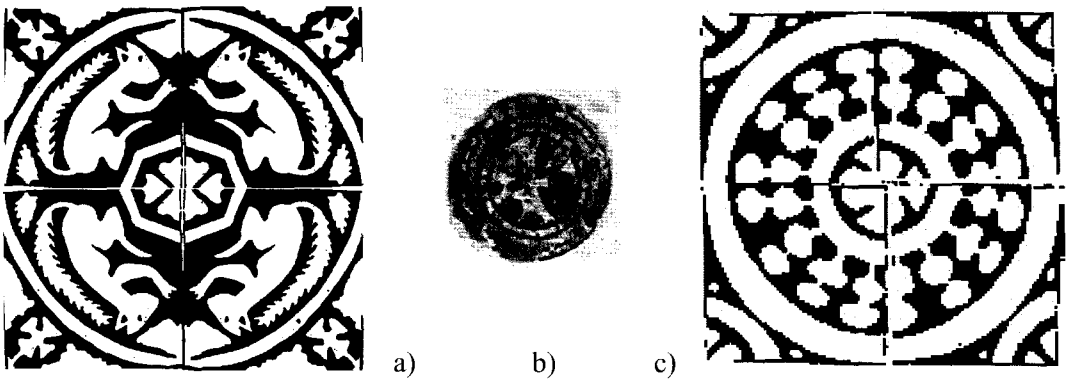


FIGURE 13 a) Made up of the largest Penn tile (P127) recorded by Hohler (5½ ins square), showing a squirrel and a cross paté . *Computer representation by Bill Bundy.* b) Twelfth-century consecration cross paté in Penn Church. *Photo by Eddie Morton.* c) Eames assigned this design (P145) to the third and last generation of Penn tiles. It has been found in Penn at Stratfords Cottage and April Cottage, and in the Bloody Tower of the Tower of London.

1970 April Cottage (T4) – Six designs of decorated floor tile wasters and plain black, brown and yellow tile fragments were found by Jonathan Dancer, the young son of Mr & Mrs David Dancer, when he was playing by digging a tunnel in the garden of April Cottage. It was at the south side of the cottage close to the road and about 2 feet below ground level. Three of the patterns were similar to those from Stratfords Cottage some 500 yds away (P50, 67/68, 74). The pattern of two of the fragments is deeply recessed below the level of the tile, while the sides of the depression show little traces of slip. This was thought to indicate some sort of printing. The tiles were given to Mr John Broadbent, who sent them to the County Museum at Aylesbury.[144]

1981 Ashwells (T5) – All the tile finds up to this point had been within the same small area at the side of the main road through Penn, but alerted by Mrs Eileen Schneider, whose father had farmed the field during the Second World War, Miles Green and Stanley and Pauline Cauvain found a heavy concentration of medieval floor and roof tiles in a field belonging to the former Ashwells Manor, between Hammersley Lane and Cock Lane, some ¾ mile from the Beacon Hill kiln. A systematic field walk by the County Museum Archaeological Group (CMAG) followed and medieval floor and roof tile fragments were found in a quantity that was assumed must be associated with a kiln. However, despite the promising presence of a deep pit in the corner of the field, no evidence of a kiln was found using a proton magnetometer.

There were plain green and light brown tiles, some of them triangular, but there were only two pieces of decorated floor tiles of which one was recognizable (a bird in a wavy circle, see Fig. 6).[145]

It has been suggested that this might indicate some degree of specialisation of manufacture. The presence of a large number of medieval pottery sherds which appear to be contemporary with the fourteenth century tiles, first suggested the new concept for Penn of joint pottery and tile production in the same kiln, though not at the same firing. John le Pottere appears in the record in c. 1349 as a companion of William Tylere in stealing rabbits from clerics at Woburn,[146] and the place-name Pot-

[144] Conversation with Mrs Pat Dancer. J. D. Broadbent, *Records of Bucks*, **23** (1981), Notes, p. 128. The designs were: P50, 67, 74, 125, 138, 145

[145] P22, which, following Eames, is one of the early, pre-Black Death designs, but this may not be right since a poorly stamped example was found recently in a house at Amersham in company with tiles that definitely belong to the post-Black Death period – see fn 154 below. It has also been found in Missenden Abbey, Pitstone and elsewhere

[146] Plea Rolls CP 40/387/61. See fn. 16

ters Cross (Fig 1) was so named before the middle of the eighteenth century.

An interesting historical note is that the Ashwells field seems to have been called Tigele furlong or Tile Field in about 1200 and the fieldwalk found Romano-British roof tile and pottery in sufficient quantity to suggest limited occupation in the first or second centuries AD. It was this material that had given the field its name when newly ploughed in the century after the Conquest.[147]

1985 Puttenham Place Farm (T6) – Mrs D. Waterton and Messrs M. Green, C. Hills and G. Randall, found many medieval floor tile fragments in the field immediately behind the Penn & Tylers Green tennis courts and next to a public footpath. Some, but not all, were wasters and were of a rather richer red colour than those found previously. There were eight different designs, four of them new to Hohler, including one embossed tile. The density and nature of the finds suggested a nearby kiln site, but none was found.[148]

Fieldwalking of the same area was carried out by CMAG and a further 17 decorated and seven plain (green, yellow & black) glazed floor tile fragments were found. They included one new design of two leopards or lions, and ten known designs one of which was for a 9-tile pattern.[149] Only one of these designs matched those found in the three Beacon Hill gardens. The five Rose Cottage kilns, discovered in 2001 and 2003, are only 200 yards away down a track, but only one of the five identifiable Rose Cottage designs found in the 2001 excavation corresponds to the 19 different designs found on the two fieldwalks.

There was more pottery found than anything else, tentatively dated from the late fifteenth to well into the sixteenth century. There was also much roof tile which had clearly been used as kiln furniture whether for tiles or pottery or both. The close association of pottery and roof tile production has been noted elsewhere in Buckinghamshire. No kiln was found and it seems more likely that the unwanted debris from a roadside kiln had been dumped on an uncultivated field, which is full of flints and so more willingly abandoned.

1985 Yonder Lodge (T7) – Pottery sherds had been found earlier in the kitchen garden of Yonder Lodge about 200 m from the Puttenham Place Farm field. They closely matched the pottery found in the fieldwalking and probably came from a separate but contemporary kiln or kilns.[150] Potters Cross is only 100 yards away.

1990 Yew Tree Cottage, Beacon Hill (T3) – This is another of the cottages at the top of Beacon Hill, a neighbour of Cobblers and Grass-Side and equally close to the large former clay pit. Over the years, the owners, Mr & Mrs Lamont have found 152 fragments of decorated floor tiles, of which 48 were identifiable. There were 20 different designs, one of which was part of a 9-tile mosaic with eight square tiles around a square central tile (Fig. 11d & Fig. 12d). There was a wide variation of thickness, from 5/8 to 1¼ ins (16 to 28mm), in the 110 pieces of tile that were measurable. This suggests that thickness by itself may not be a sufficiently reliable indicator of the three types of Penn tile identified by Elizabeth Eames.

There was only one unrecorded design, but it is an important one, since it is about 6 inches (150mm) square and 1¼ inches (33mm) thick, significantly bigger than the normal 4½ inches by ¾ inches. It has a unique design of a king's face and hands deeply impressed to a depth of up to 2mm (Fig. 2a). The fabric appears to be very similar to the others from the same garden and unless it was imported from elsewhere it could represent an

[146] Plea Rolls CP 40/387/61. See fn. 16

[147] Pauline Cauvain, Stanley Cauvain & Miles Green, 'Prehistoric, Romano-British and fourteenth- century activity at Ashwells, Tylers Green, Bucks', *Records of Buckinghamshire,* **31** (1989), pp. 111–19

[148] Pauline Cauvain, 'Penn tiles from Puttenham Place Farm', *Journal of Chess Valley Archaeological and Historical Society* (1987), pp. 25–6. The four known designs were P131,142, and LB15 & LB 18, now known to have been Penn designs

[149] Naomi Hutchings & Michael Farley, 'A fifteenth to sixteenth-century pottery industry at Tylers Green, Buckinghamshire', *Records of Buckinghamshire,* **31** (1989), pp. 105–11. The closest Eames leopard designs are E1503–5, but they are not at all similar. The ten known designs were: P68, 73, 86,103, 120, 128, 130, 142, 164, 172B (9-tile design)

[150] *Ibid.*, p. 110

earlier phase of Penn tiling. More comparative material is needed.[151]

2001 Rose Cottage, Elm Road (T8) – The archaeological evaluation of this site has already been discussed in some detail (Fig. 9). Eleven fragments of medieval Penn tiles were found, five nearly whole with identifiable designs.[152]

2001 Grass-Side, Church Road (T3) – Two huge boxes of tile fragments, the findings from 30 years of gardening, were donated by Mr and Mrs Edwards, the owners of Grass Side, for the Lady Chapel project described below. An inspection by Stanley & Pauline Cauvain found no unrecorded tiles. The bulk were decorated, but there were a significant number of plain glazed tiles with green, light brown and black colouring, including several triangles of different sizes.

2002 Lady Chapel Millennium floor tile project – There have not been any Penn tiles on display to the public in Penn or Tylers Green, following the removal of those in the chancel of Penn Church in 1918. It was therefore decided that they should be built into the Lady Chapel as part of its Millennium restoration. The British Museum readily returned those that had been submitted for an opinion in 1967 and a local appeal produced a generous response, with a very large number coming from the garden of Grass-Side in Church Road.

Twenty-five different designs have been used to make up a mosaic on the altar platform and they are set in a surround of Bath stone. A centre of complete, newly-made tiles of a typical Penn four- tile design, gives a very good idea of how a complete floor would have looked when it was laid (Fig. 10c). Mrs Diana Hall made these new tiles, following the same methods of preparation, forming, decorating and glazing as the fourteenth century tilers, although using a modern gas kiln. The colour and appearance of the original tiles has been captured very effectively and the overall effect is both informative and pleasing.

2003 Rose Cottage, Elm Road (T8) – The archaeological evaluation of what has turned out to be a sequence of at least five kilns has already been discussed in detail.[153]

2004 64 Whielden Street, Amersham – In the neighbouring parish, but included because it would seem to be rare evidence of the use of the tiles at the local level of prosperous townsman. 17 whole tiles were found when digging foundations for a kitchen extension, including three complete sets of 4–tile designs. The tiles are to be put on display in the Amersham Museum.[154]

ACKNOWLEDGEMENTS

A Millennium project to display Penn tiles in the Lady Chapel of Penn Church, largely funded by the Countryside Agency's Local Heritage Initiative, included the requirement for an explanatory leaflet, which has grown into this article as unanswered questions presented themselves. I make no claim to be either an archaeologist or an expert on medieval floor tiles. Christopher Hohler's two earlier *Records* articles and Elizabeth Eames' monumental *Catalogue* have provided the basis for my enquiry, together with the long list of authors listed in the Introduction.

I also gladly acknowledge indispensable help from Eddie Morton, who took most of the photographs; Bill Bundy who spent many hours on his computer recreating the floors of the Aerary and Penn chancel, as well as several of the illustrations; and Mike Lamont who drew the excellent sketch of the imaginative reconstruction of a kiln.

I am grateful for encouragement and detailed and constructive criticism from Dr Ian Betts of the Museum of London and for a tiler's expert advice from Mrs Diana Hall, who both set out the mosaics of old tiles and made the new ones in the Lady Chapel of Penn Church. Mrs Enid Davies, Assistant Archivist of the St George's Chapter library, provided access to the Aerary and ready assistance. The River and Rowing Museum at Henley, pro-

[151] Pauline & Stanley Cauvain, 'New discoveries of Penn tiles', *Records of Buckinghamshire*, **33** (1991), pp. 44–8. The recorded designs were: P34, 49, 50, 54, 58, 62, 66, 69, 71, 85, 88, 101, 143, 156; Eames 2836, 1845, 2030, 1360, 2388, 2864 (mosaic). The two most numerous were P88 & P101. The mosaic E2864 is small and thick (90x88x25mm or 3½ x3½ x 1 inch) and similar in shape to P117, found at Stratford's Cottage, which Hohler described as unique.

[152] See fn. 104 above. The designs were: P44, varn. 55, varn. 88/89, 130, 152

[153] See fn. 104 above

[154] A 4–tile set of P44; two 4–tile sets of P143 & one extra; P22; P41; P60; P140

vided two key articles on the medieval use of the Thames. Dr Jonathan Hunn, David Fell and Joe Abrams, of Archaeological Services and Consultancy Ltd, have been generous in allowing unrestricted use of the reports and photographs of their two Rose Cottage excavations. John Clarke and Mike Farley have made many suggested improvements following painstaking reviews of the text and illustrations. The Penn Trust contributed £300 towards the cost of coloured illustrations.

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