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Chapter 4: Tin, Lead and Pewter
by Ronald F. Homer

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Tin, Lead and Pewter

RONALD F. HOMER

Only three non-ferrous metals were mined commercially in medieval Britain: tin, lead and silver. Tin was fundamental to the country's economy, since between *c.*300 and 1300 England was the only significant European producer of this metal. Even much later it was an important export, and an unknown poet wrote in 1436:

> For Spayne and Flaundres is as yche othere brothere,
> And nethere may well lyve wythowghten othere.
> They may not lyven to mayntene there degrees,
> Wythoughten oure Englysse commodytees,
> Wolle and tynne....[1]

By contrast much lead was mined for the purpose of recovering the silver which occurs in argentiferous lead ores, for desilvered 'sterile' lead was produced in abundance throughout Europe and the market appears frequently to have been surfeited. The Crown's interest in tin for its own sake, and in lead for its silver content, led to early grants of extensive rights and privileges to the miners of both metals. Both King John's charter to the tinners of Devon and Cornwall in 1201 and that of Henry III to the lead miners of Alston Moor (Cumb.) in 1235 confirmed longstanding rights.[2]

Alloyed with copper, tin formed bronze, the only readily worked and readily available metal which was both resistant to corrosion and of reasonable strength and durability. Tin was used for the tinning of culinary and decorative wares made from copper alloys and iron, and alloyed with small amounts of lead or copper (or both of these) it provided the raw material for England's growing pewter industry. Much lead was used in building construction and for large domestic and industrial vats.

1 *The Libelle of Englyshe Polycye* ..., ed. George F. Warner (1926), lines 86-90.

2 Charter of King John, *Cal. Charter Rolls, 1225-57*, 380 (the document is an *inspeximus* of the 1201 charter). Charter of Henry III, *Cal. Patent Rolls, 1232-47*, 65, 132, 174.

Alloyed with tin it formed solder, and with copper it formed a range of bronze-like alloys used for cheap domestic utensils. The unsatisfactory quality of some of these was complained of in 1316, 'for the moment they are put upon the fire and exposed to great heat, they come to nothing and melt'.[3] From the mid 14th century the working of tin (as pewter) and of lead was regulated by 'crafts' which laid down rules for their members and for the protection of the consumer from poor workmanship and excessive prices.

The archaeological remains of medieval mining and working of tin and lead are unimpressive, and surviving artefacts are unrepresentative of much that was made.[4] Considerable reliance has therefore to be placed on documentary evidence in reconstructing these industries.

Tin Mining and Trade[5]

Tin mining in Devon and Cornwall dates from *c.* 500 BC and was important in Roman times, particularly after the Spanish mines failed in the 3rd century AD. Archaeological evidence (mainly coin finds) indicates working in the 9th and 10th centuries and English tin was an article of commerce in Europe at this time.[6] Curiously, tin mines are not mentioned in the Domesday survey. From the 12th century all the tin produced in Devon and Cornwall (Cornwall being the dominant producer after *c.* 1220[7]) was subject to a tax, the coinage, for the levying of which it had to be brought at specified times to one of the coinage towns. These were Chagford, Ashburton, Tavistock and (from 1328) Plympton in Devon, and Lostwithiel, Bodmin, Liskeard, Truro and Helston in Cornwall. Coinage and coinage farm returns enable tin production to be calculated for much of the period after 1156 (Table I). The retail price of tin in Cornwall in the early 14th century was 1*d.*-1½*d.* per pound; it doubled after the Black Death, but steadied at 1½*d.*-2*d.* between about 1400 and 1460.[8] Hence the tin produced in 1400 was worth *c.* £10,000 to the ultimate local vendors.

The miners of tin, and equally of lead, could prospect for ore anywhere except in gardens, orchards, churchyards and on the highway. They could cut wood, dig peat, divert watercourses and make roads; they were subject to the jurisdiction of their own courts and were exempt from certain taxes.[9] This was not without repercussions. In 1314 Devon miners were said to be laying waste over 300 acres a

3 Riley, *Memorials*, 118. cf. p.82 below.
4 T.A.P. Greeves, 'The Archaeological Potential of the Devon Tin Industry', and I.S.W. Blanchard, 'Lead Mining and Smelting', in D.W. Crossley (ed.), *Medieval Industry* (C.B.A. Research Rep. xl, 1981).
5 See particularly J. Hatcher, *English Tin Production and Trade* (1973), for a comprehensive study. Much of the data in this section is taken from this source. Hereafter cited as 'Hatcher, *Tin*.'
6 Ibid. 16-17. For an important recent discussion of Anglo-Saxon tin production in the south-west see J.R. Maddicott, 'Trade, Industry and the Wealth of King Alfred', *Past and Present*, cxxiii (May 1989), 3-51.
7 H.P.R. Finberg, *Tavistock Abbey* (1955), 173.
8 Hatcher, *Tin*, 90-1.
9 Finberg, op. cit. note 7, 169-70; Salzman, *Industries*, 46-9.

Fig. 17 A one-pound lead weight cast with the arms of England ancient, within a border of pellets. Height 70 mm. (*Museum of London*)

Fig. 18 The lead coffin of Anne Mowbray, child widow of Richard, duke of York, who died in 1481 aged eight. (*Museum of London*)

year,[10] and in Cornwall in 1361 John de Treeures complained to the Black Prince that:

> whereas for a long time tinners have dug and gathered tin in the waste moor of himself and his ancestors ... and he and his ancestors ... have received from them as toll a third of the tin so dug ... now of late fully sixty tinners have entered on his demesne and soil, which bears wheat, barley, oats, hay and peas, and is as good and fair as any soil in Cornwall, and have led streams of water ... over part of his said demesne and soil, so that by reason of the great current of water they have obtained and the steep slope of the land there, all the land where they come will go back to open moor, and nothing will remain of all that good land except great stones and gravel...[11]

The secondary alluvial deposits of oxide ore, *cassiterite*, worked in the medieval period, the so-called 'stream works', required only crushing and washing before

10 Finberg, op. cit. note 7, 176.

11 *Register of Edward the Black Prince*, pt.2, *Duchy of Cornwall, 1351-65* (1932), 178.

TABLE I

Annual tin production in typical years between 1156 and 1487[1]

Years (see notes)	Production	Years (see notes)	Production
1156-60[2]	100-130	1366	508
1163-8	140-170	1379	919
1170-89	480-580	1385	1084
1198	869	1395	1341
1209	612	1407	1418
1214	1199	1418	1117
1303[3]	874	1425	1263
1309[4]	817	1435	926
1316	740	1445	852
1324	991	1455	823
1332	1644	1465	864
1342	1159	1477	1034
1351	237	1487	1103

1 Figures from Hatcher, *English Tin Production*, Appendix A. Quantities are in thousandweights of 1000 lbs. In Devon the thousandweight was of 1200 lbs.; in Cornwall 1000 lbs.
2 Figures for 1156-89 are estimates from the value of the farm.
3 Figures for 1243-1300 are available for Devon only.
4 Figures for 1309-1366 are those giving Cornish production only which is probably between 80 and 90% of the combined Devon/Cornwall production.

being smelted with peat or charcoal; in early medieval times, smelting was in simple open fires.[12] Although exhaustion of these deposits eventually necessitated deep open-cast and shaft mining of the main lodes, this does not appear to have been significant before about 1500. Until the late 12th century a second, refining, smelting of the metal was customary, but it became unnecessary as primary smelting improved, probably as a result of the introduction of furnaces with a forced draught.[13] The metal was cast into blocks in stone moulds and, after coinage, was stamped to show that duty had been paid.[14] Only then could it be sold freely.

Many miners were employed by the owners of large mines, and Abraham the Tinner in 1337 claimed to employ the exceptional number of 300 men in seven separate works.[15] Others worked as individuals, but their fortunes were mixed. No doubt for many of them tin mining was only a secondary occupation, but nevertheless many found difficulty in subsisting from one coinage to the next and were forced to pledge their tin in advance to speculators and merchants, some of

12 Finberg, op. cit. note 7, 169; Forbes, 'Metallurgy', in Singer, *Hist. of Technology*, ii, 47.
13 Greeves, op. cit. note 4, 87.
14 Ibid. 90.
15 Hatcher, *Tin*, 62.

Fig. 19 The cast-decorated lead font at Frampton-on-Severn (Glos.), *c.* 1130-40. One of 30 surviving English decorated medieval lead fonts, of which 16 date from before 1200.

whom captured significant shares of the market. Tin presented for coinage varied from quantities exceeding 100 thousandweights by the great landowners and merchants, to only a few hundred pounds from some individual miners. It has been calculated that there were perhaps 2,000 Cornish miners in 1300 and 5,000 by 1400,[16] and that a miner presenting a thousandweight a year earned 3*d.* a day in 1330.[17]

In the 12th century tin was exported in quantity directly from Devon and Cornwall to France and Flanders and thence to other destinations in Europe and beyond. In 1195, 254 thousandweights were shipped to the king in La Rochelle.[18] Two Bayonne merchants bought no less than 240 thousandweights in 1198 and merchants from Brabant regularly visited Devon and Cornwall in the 12th and 13th centuries. The Hanseatic merchants had installed an agent in Falmouth in 1265, but indigenous production in Saxony and Bohemia led to a waning of their interest by the early 14th century. From about 1330 exports were dominated by the Italians; a

16 Ibid. 67.
17 L.F. Salzman, 'Mines and Stannaries', in J.F. Willard et al. (ed.), *The English Government at Work 1327-36*, iii (1950), 93.
18 Finberg, *Tavistock Abbey*, 172.

Bardi merchant exported tin worth £520 in 1339 and £724 in 1340. Forty years later the focus of the export trade had shifted to Southampton and to a lesser extent to London; there was significant trade with the Low Countries and elsewhere, and some of this was in English hands. Transport of the metal from the coinage towns to London and other destinations in Britain was frequently by sea, Southampton being a staging point whence some was diverted for export and some continued overland to London.[19]

Lead Mining

The main centres of lead mining, which waxed and waned in their relative importance, included Yorkshire, Durham, the Peak District of Derbyshire, Flintshire, the Mendips and South Devon.[20] In the 1170s the Scots' incursions disrupted production in the north of England, and this, at a time of increasing demand for architectural lead, necessitated the exploitation elsewhere in England of ores of low or negligible silver content. Despite the ready accessibility of such deposits on or near the surface, the economics of working them were highly uncertain. In many mines the isolation of at least some silver was essential for survival. The Birland mine in Devon had total expenses between 1325 and 1334 of £870 against an income of £591 for silver and only £147 for lead.[21] The operation of the mine was subsidised by loans from the king and elsewhere. What this meant at the individual mine is strikingly illustrated by the meagre inventories of the Beer Alston mine for 1325 and 1338. These include 2 worn-out anvils, a worn-out cart, worn-out bellows, 13 worn-out sacks for ore, a worn-out boat and oars, a broken saw, a broken balance and a pack horse 'of practically no value'.[22] In 1335 the Beer Alston staff comprised an overseer at 14*d.* a week, a boler at 15*d.* with two assistants at 8*d.*, a furnaceman at 12*d.* with blowers at 2*d.* a day, a keeper of the woods and an overseer of the woodcutters, a smith at 10*d.* a week with an assistant at 1½*d.* a day and a chandler at 8*d.* In addition there were two silver refiners at 18*d.* a week with assistants at 8*d.*[23] The presence of a chandler, and the record in the inventory of the use of half-a-ton of candles a year, indicates that shaft mining was undertaken – an enterprise justified only for the extraction of silver-rich ores. The rudimentary technology available for the draining of mines, limited to bailing until the late 13th century and thereafter by means of adits (drainage tunnels) where the lie of the land permitted, was a serious constraint on anything other than open-cast mining. Where the silver content did not justify its extraction, economic viability depended on the extent and accessibility of the ore so as to allow easy migration from site to site as

19 Hatcher, *Tin*. Chapters i, iv and vi and Appendix B discuss both the internal and external medieval tin trade in considerable detail.

20 I.S.W. Blanchard, 'Lead Mining and Smelting', in Crossley (ed.), *Medieval Industry*, gives a detailed survey of the various lead fields and techniques.

21 Salzman, art. cit. note 17, 80.

22 Ibid. 70-71, for a full transcript of the inventories.

23 Ibid. 71.

deposits became depleted, and on the local availability of adequate timber as fuel.

Miners might work on their own account, giving a proportion of the ore to the owner of the mineral rights, or as employees paid on a piece-work basis. At the Beer Alston mine in 1298, miners received 5*s*. for a 'load' of ore amounting to nine 'dishes' of some 60 lbs. per dish. Those engaged in 'dead work', i.e. those prospecting in as yet unproductive workings, received wages, which in 1320-30 amounted to only 1*d*.-1½*d*. a day.[24]

The modern commentator will be struck by the small scale of medieval mining operations. The total production of the Derbyshire lead field in 1300 amounted to some 391 'fothers', about 370 tonnes.[25] The total English and Welsh output, from the efforts of thousands of miners, was 385 tonnes in 1400, 400 tonnes in 1450 and 625 tonnes in 1500.[26] A single miner might win no more than 30-40 lbs. of crushed and washed ore a day. As lead sold at the mine for about ⅓*d*. per lb. in 1330 and ½*d*. in 1430-1500,[27] the economic value of this geographically scattered industry was small indeed.

Smelting of the prevalent 'black ore', *galena* (lead sulphide), does not require a reduction with charcoal, and the metal results from a two-stage roasting of the ore. Until the end of the 13th century, and in places until much later, this was done in a simple 'bole' comprising a hearth surrounded by a stone wall with a wind tunnel in the side facing the prevailing wind.[28] On a foundation of logs were piled layers of brushwood and crushed ore and the bole was fired when the wind was favourable. Imperfectly controlled roasting resulted in much lead remaining in the slag as oxide and sulphate. This mattered little while ore and fuel were plentiful, but by the 1280s shortages of fuel became a problem. A partial answer was the 'turnbole', in which the hearth was mounted on a massive wooden platform which could be rotated to take advantage of the wind from any direction, thus eliminating firings which had to be aborted due to an unexpected wind change and the stock-piling of ore while a favourable wind was awaited.[29] Its advantages were more apparent in the sometimes urgent smelting of argentiferous ores, than in the more leisurely production of lead for its own sake.

Shrinking fuel resources and depletion of readily accessible ores eventually led to the need to recover residual lead from bole slag, the so-called 'blackwork'. From the 14th century this was reprocessed by reduction with charcoal in a 'blackwork oven', which was essentially a circular, stone-built blast furnace fed with air from bellows operated by 'blowers' or by water power.[30] Such charcoal reduction of lead ores was not new; the less common 'white ore', lead carbonate, was necessarily smelted in this way. For the isolation of silver from 'fertile' (argentiferous) lead, a process

24 Salzman, *Industries*, 51-2.
25 I.S.W. Blanchard, 'Derbyshire Lead Production', *Derbs. Arch. Jnl.* xci (1971), 119-40, 125.
26 I.S.W. Blanchard, 'Labour Productivity...', *Econ. Hist. Rev.* 2nd ser. xxxi (1978), 1-24, 24.
27 Salzman, op. cit. note 17, 78-9, and Blanchard, 'Labour Productivity...', 19, respectively.
28 Blanchard, 'Lead Mining and Smelting', 72 and Fig. 73.
29 Ibid. 77.
30 Ibid. 78 and Fig. 75.

unchanged from ancient times, fertile lead was subjected to cupellation in a current of air which oxidised it to litharge, leaving a residue of silver metal. The litharge was reworked by charcoal reduction to yield sterile lead containing only some 0.01 per cent of residual silver.[31]

Lead Working

The essential use of lead in permanent buildings resulted in the early recognition of lead working as a separate trade. A leadworker and lead vessels are mentioned in an early 11th-century treatise on estate management, and Godric Plumberre is recorded sometime between 1102 and 1107.[32] Walter Plumarius appears in the Pipe Roll for 1175-6 which contains details of lead purchased for work on Westminster Palace, the Tower of London and the 'house of God at Grantmonte'.[33] Osbert Plumberius (alias Osbert le Plumer, le Plumbere and le Plummer) and William Plummerius witnessed various London deeds between *c.* 1200 and 1220.[34] Plumbers were also found widely in the provinces in the 13th century. In Oxford, John and Randolf Plumbator appear in 1260[35] and in rural Wales Simon le Plumber and Henry le Plumber are recorded in Welshpool in 1293.[36] No doubt they were employed on Edward I's castles. In 1335 it was reported of Portchester castle that 'the great tower is unroofed ... and can be repaired with 20 fodders of lead worth 60*s.* and for the wages of the plumbers and other expenses ... 60*s.*'[37] Lead, as an essential building material, was transported for long distances overland: for example, five-and-a-half fothers (about five tonnes) arrived in Southampton in five 'waynes' from Derby in 1444.[38]

Roofing lead was cast on a bed of sand into sheets *c.* 4mm. thick which were joined at the sides by being rolled round the edge of the adjoining sheet and were secured at their lower edges by iron clips.[39] Lead pipes were made from sheet on wooden formers and the seams soldered.[40] Window glass was secured in 'H'-shaped lead 'calmes' which were cast in two-part hinged iron moulds.[41] As a domestic vessel,

31 Forbes, 'Metallurgy', op. cit. note 12, 43-5.

32 'The Gerefa', printed by W. Cunningham, *The Growth of English Industry and Commerce: Early and Middle Ages*, i (6th edn., 1915), 571-5; for Godric Plumberre see P.H. Reaney, *The Origin of English Surnames* (1984), 191 (citing the Cartulary of Ramsey Abbey).

33 *Pipe Roll 22 Henry II* (Pipe Roll Soc. xxv, 1904), 120, 13, 14, and 141, respectively.

34 *Cartulary of St. Bartholomew's Hospital*, ed. N.J.M. Kerling (1973), Nos. 531, 533, 535, 541, 542, 543, 554 and 560.

35 *Cartulary of the Hospital of St. John Baptist*, ed. H.E. Salter, ii (Oxford Hist. Soc. xviii, 1915), 290, 293 etc.

36 R. Morgan, 'A Powys Lay Subsidy Roll', *Montgomeryshire Collections*, lxxi (1983), 111-2.

37 *Cal. Inquisitions Misc. 1307-49*, No.1472. The sum of 60*s.* for 20 fodders of lead appears to be an error for £60.

38 *Brokage Book of Southampton*, 1443-1444, ed. Olive Coleman, ii (Southampton University, 1961), 280.

39 Briggs, 'Building Construction', in Singer, *Hist. of Technology*, ii, 445.

40 A detailed account of the making and laying of the lead pipe-work for an aqueduct to Waltham Abbey in 1220, from B.L. MS Harl. 391, is given by G.H. Busby, 'The Holy Springs of Waltham Abbey', *Trans. E. Herts. Arch. Soc.* viii (1928-33), 177-83. See also R.A. Skelton and P.D.A. Harvey (eds.), *Local Maps and Plans from Medieval England* (1986), 59-70.

41 Theophilus, *On Divers Arts*, ed. Hawthorne & Smith, 67-8.

the *plumbum* of large size was in common use. The London eyre justices in 1244 found two cases of women being scalded to death by falling into such vats, one containing boiling water, the other hot mash.[42] Five similar fatalities were recorded in the eyre for 1276.[43] In *c.* 1252 'a woman named Cecily and her maid Juliana were fighting indoors and near a leaden vessel full of hot water. During the fight both fell into the vessel and were scalded to death'.[44] Christine de Bennington of Lincolnshire, who died in 1283, bequeathed a leaden vessel to her niece, and her inventory lists four such vessels. In 1327 Avice de Crosseby of Lincoln left 'one very small leaden vessel to mend the eaves or gutter of the church of St. Cuthbert'.[45] The inventory of a London brewer in 1335 includes leaden brewing vessels[46] and inquisitions taken of the goods of Michael de la Pole in 1388 record leaden hand basins, leaden stills, a lead vat, a lead cistern 'near the door of the chamber' and a lead pan in the slaughterhouse.[47] Clearly lead vessels were in widespread use, even though the toxic properties of the metal were well recognised. Nor were utensils the only risk to the citizen. A number of residents of Candlewick Street complained in 1371 that certain plumbers

> do purport to melt their solder in a vacant place called Wodehaw ... to the great damage and peril of death to all who shall smell the smoke from such melting for whoever has smelt the smoke therefrom has never escaped without mischief.

The mayor and aldermen ruled that the work could continue,

> it having been testified before them that the place aforesaid had for many years past been let to men of the trade,

but that the height of the chimney on the furnace should be increased.[48]

The 1365 Ordinances regulating the plumbers' craft provide for apprenticeship for seven years, forbid casual dealing in secondhand lead, provide for orderly marketing and lay down a rate of ½*d.* 'for working a clove of lead for gutters or for the roofs of houses' and 1*d.* 'for working a clove for furnaces, *tappetroughs*, belfreys and conduit pipes'.[49] Among the minor uses for lead may be mentioned weights (Fig. 17), which for common trade purposes were usually made of lead (unsatisfactory though it was) until the 16th century; coffins, shaped to fit the corpse and soldered round the edge (Fig. 18); small cannon-balls, badges, ink-pots and writing points. Surviving examples of high quality decorative leadwork are the ornate relief-cast fonts dating

42 *London Eyre of 1244*, ed. H.M. Chew and M. Weinbaum (London Rec. Soc., vi, 1970), Nos. 95, 137.
43 *London Eyre of 1276*, ed. M. Weinbaum (London Rec. Soc., xii, 1976), Nos. 13, 14, 21, 43 and 211.
44 Ibid. No. 13.
45 *Lincoln Wills*, v, ed. C.W. Foster, i (Lincoln Rec. Soc., v, 1914), 2-3 and 6.
46 Riley, *Memorials*, 193-4.
47 A composite list from *Cal. Inquisitions Misc., 1387-93*, Nos. 68, 76, 94, 102.
48 Riley, *Memorials*, 355-6.
49 Ibid. 321-3 for the full text. The meaning of 'tappetroughs' is obscure.

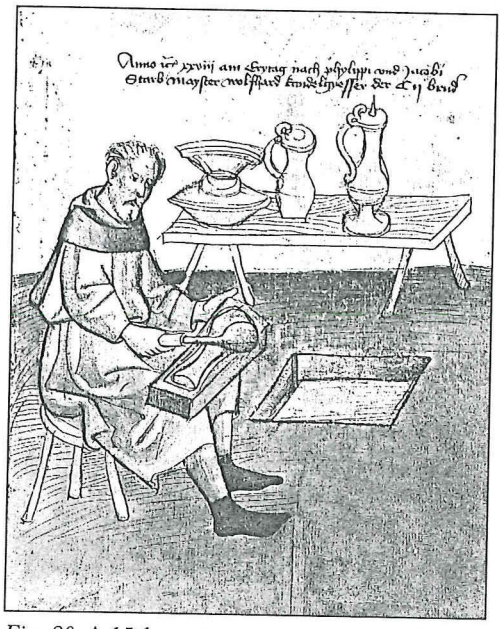

Fig. 20 A 15th-century pewterer at work casting the body of a flagon. From the *Housebook of the Mendel Brotherhood.* (*Stadtbibliothek, Nuremberg*)

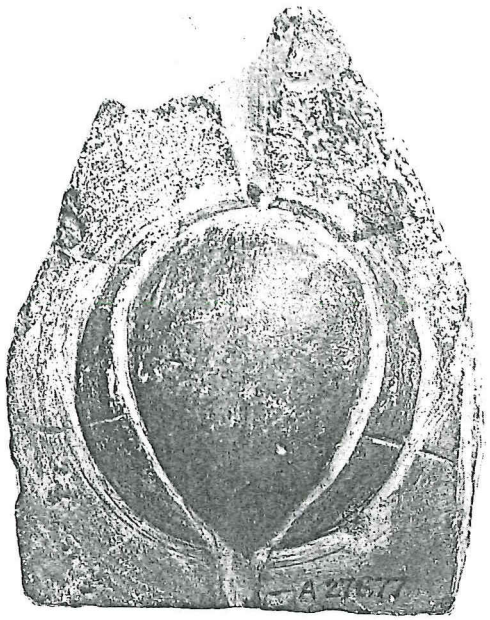

Fig. 21 A fragment of a stone mould for casting a pewter spoon, *c.* 15th-century. *(Museum of London)*

from the 12th century (Fig. 19).[50] Significant quantities of the metal must also have gone irreversibly into lead glazes for pottery and into lead-based pigments.

Pewter

The earliest mention of English pewter vessels is found in a letter written by Ælfric for archbishop Wulfstan in *c.* 1006. This lays down that chalices should be made of fusible material, gold or silver, glass or tin (*tinen*), not of horn or wood.[51] However, there is no record of where or by whom these vessels were made. Theophilus, writing in the early 12th century, gives directions for making pewterware and it is possible that some manufacture took place within the religious communities themselves.[52] The technology is simple. The low-melting alloy can be cast in clay moulds, if necessary by the lost wax technique, or even in moulds of wood. The rough casting is finished on a lathe, the parts soldered together and the whole smoothed with abrasives and polished (Fig. 20).

Fragments of multi-part stone moulds for casting small items such as tokens,

50 Zarnecki, *English Romanesque Lead Sculpture*; see also G. Zarnecki et al. (ed.), *English Romanesque Art*, Exhibition catalogue, Hayward Gallery, London, (1984), 247-8.

51 *Councils and Synods, with Other Documents Relating to the English Church, A.D. 871-1204*, eds. D. Whitelock, M. Brett and C.N.L. Brooke (1981), i, pt. 1, 292. See also Albert Way, *Suss. Arch. Collns.* ix (1857), 310.

52 Theophilus, *On Divers Arts*, ed. Hawthorne & Smith, 179-82.

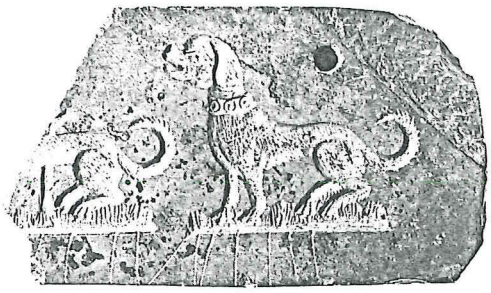

Fig. 22 A fragment of a stone mould for casting pewter badges, 15th-century.
(*Museum of London*)

Fig. 23 An originally circular lead ingot from Criccieth Castle. Diam. *c.* 523mm.
(*National Museum of Wales*)

spoons and badges survive from the 14th century (Figs. 21, 22), but moulds of bronze were in general use by at least the later part of that century. No doubt these were expensive, and some elegant pewter flagons and cruets with hexagonal or octagonal bodies were made without the use of moulds by soldering together appropriately shaped strips cut from flat sheet (Figs. 24, 25). Probably these are the items described in contemporary documents as 'square pots'.

No mention of domestic pewterware has been found before the 1290s.[53] Pewter pitchers and a basin are recorded in the larder of Berwick-on-Tweed castle in 1292,[54] and the earliest London pewterer so-called appears to be John le Peutrer, recorded in 1305.[55] He, with Geoffrey, Thomas and William le Peutrer, appears later in the 1319 subsidy roll when they were assessed at rates typical of the modest craftsman and shopkeeper.[56] Thomas and William reappear in the 1332 roll paying 4*s.* (1319: 10*d.*) and 5*s.*4*d.* (1319: 13½*d.*) respectively,[57] indicating a rapidly expanding business. Significantly, another early London pewterer, Henry le Peautrer (dead in 1312), was known also as Henry le Calycer (chalice-maker); this not-uncommon name, which occurs as early as *c.* 1190, must conceal a number of 13th-century workers in pewter whose main business was the production of chalices.[58] Gilds of pewterers existed in

53 The 300 pieces of pewter attributed by M. Bell, *Old Pewter* (1905), 55 to Edward I in 1290 are now known to have been pottery vessels. See R. Weinstein in *Pewter, a Celebration of the Craft* (Museum of London, 1989), 33.

54 *Documents Illustrative of the History of Scotland, 1286-1306*, ed. Joseph Stevenson (1870), i, 342.

55 *Cal. of London Trailbaston Trials, 1305-6*, ed. R.B. Pugh (1975), No. 109.

56 *Two Early London Subsidy Rolls*, ed. Eilert Ekwall (Lund, 1951).

57 M. Curtis, 'The London Lay Subsidy of 1332', in G. Unwin (ed.), *Studies in Finance and Trade Under Edward III* (1913).

58 The identity is shown by Hustings Enrolled Deeds, Roll 53(85),(89) and Roll 57(119), (120) at the Corporation of London Records Office. See R.F. Homer, 'The Origin of the Craft in London', *Jnl. of the Pewter Soc.* v 1985-6 54-7.

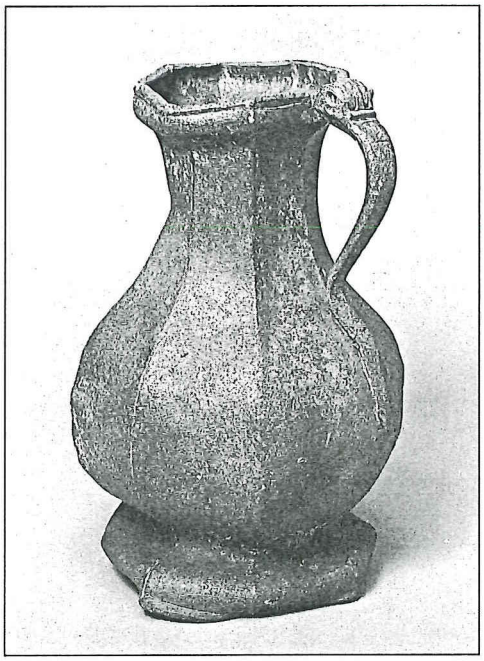

Fig. 24 The body of an octagonal pewter flagon made from segments of shaped sheet soldered together, mid 14th-century. Excavated in Gloucestershire. A similar flagon has recently been recovered from the Medway near Tonbridge and others have been excavated in Europe. Height 240 mm. Analysis (%): Sn, 97.7; Pb, 0.57; Cu, 1.55.

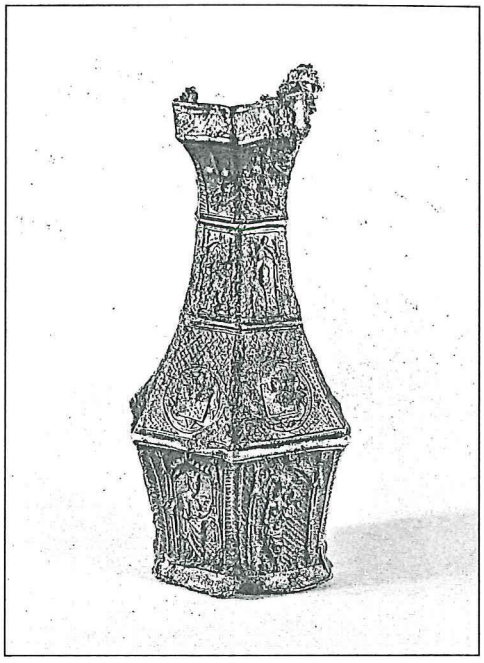

Fig. 25 An elaborately cast-decorated pewter cruet body of almost pure tin, from Weoley Castle, Birmingham, first half of the 14th century. It is made from twelve separate panels and an inserted base, all soldered together. A similar cruet was excavated at Ludlow. Analysis (%): Sn, 99.9; Pb, 0.04; Cu, below 0.03. (*Birmingham Museum and Art Gallery*)

Europe well before 1300 (for example in Paris in 1268),[59] but ordinances were not granted to the London pewterers until 1348.[60]

Outside London, pewterers, as suppliers of consumer goods to the wealthier citizens, are to be found in many large towns before 1400 (Table II). In addition, for different reasons, there was a clandestine trade in Cornwall as early as 1327, where ware was being made from uncoined tin. Pewterers are recorded subsequently in Canterbury (1438), Hull (1464/5), Ipswich (1453), Northampton (1414), Reading (1468), Shrewsbury (1463), Southampton (1443), Wells (1435) and Wigan (1470). In 1474 the Pewterers' Company, exercising the countrywide right of search granted in its first charter, seized substandard wares from pewterers working in Abingdon, Bedford, Boston, Brainsford, Bridgwater, Bury St. Edmunds, Cambridge, Chelmsford, Chichester, Colchester, Leicester, Montacute, Taunton, Thetford, Winchester and Wookey, in addition to some of the earlier recorded towns.[61] Ware

59 E.S. Hedges, *Tin in History* (1964), 86.
60 Riley, *Memorials*, 241-2 for the full text.
61 Guildhall Library, London, MS 7086/1, Pewterers' Company Audit Book.

TABLE II

Provincial Pewtering Towns before 1400

Lostwithiel	1327	Richard peautrer[1]
Bristol	1343	John le peautrer[2]
York	1348	William de Ordesdale[3]
Kings Lynn	1350	Johannes Peutrer[4]
Coventry	*c.* 1370	Hugo le peutorer[5]
Exeter	1370	Richard Osborne[6]
Norwich	1371-2	Nicholas atte Pirye[7]
Truro	1379	Richard Pyauterer[8]
Salisbury	1397	Geoffrey Peautrer[9]
Lincoln	1398	John Sparrow[10]
Walsall	?1399	John Filkes[11]

1 H.L. Douch, *Jnl., Royal Inst. of Cornwall*, vi. 1 (1969), 65-80.
2 *Cal. Close Rolls, 1343-6*, 124.
3 J. Hatcher and T.C. Barker, *A History of British Pewter*, 40; Massé, *The Pewter Collector* (1921), 53, refers to William the wiredrawer who worked in pewter in 1320.
4 *The Red Register of Kings Lynn*, transcribed by R.F. Isaacson, ed. Holcombe Ingleby (n.d.), ii, 84, 170.
5 *Register of the Trinity Guild of Coventry* (Dugdale Soc., xiii, 1935), 11.
6 *Exeter Freemen*, ed. M.M. Rowe and A.M. Jackson (Devon and Cornwall Rec. Soc., extra ser. i, 1973).
7 J. L'Estrange, *Cal. of Freemen of Norwich*, ed. Walter Rye (1888). The record is incomplete between 1328 and 1364.
8 Douch, as in note 1.
9 *Cal. Patent Rolls, 1396-9*, 298. He owed £20 to a London pewterer.
10 *Cal. Close Rolls, 1396-9*, 348.
11 *Cal. Patent Rolls, 1396-9*, 496; *V.C.H. Staffs.* xvii, 196 and note.

seized at Abingdon included plates, dishes, saucers, small saucers, great saltcellars, middling saltcellars and tavern pots of quart, pint and half-pint capacity.[62]

The growth of the craft in London can be followed in considerable detail. From information collected from contemporary sources about some 200 London pewterers working before 1450[63] (believed to include the great majority) can be derived an indication of the numbers of pewterers working in the capital at the end of each decade (Table III). The depression following the Black Death and the upturn consequent on the growth of the economy and the increased number of monied people after 1400 is clearly apparent, and comparison with the relatively constant number of London goldsmiths shows the increasing importance of the pewterers. The output of these pewterers is conjectural, but present-day concerns, making pewterware by hand methods differing little from those used in the Middle Ages,

62 Ibid.
63 R.F. Homer, 'The Medieval Pewterers of London *c.* 1190-1457', *Trans. London & Middlesex Arch. Soc.* xxxvi (1985), 137-63. A list of London pewterers by R.F. Homer is also deposited at Guildhall Library, London.

TABLE III

Estimated number of Pewterers working in London 1310-1460

Date	Number of Pewterers	Number of Goldsmiths
1310	5	–
1320	13	–
1330	17	–
1340	20	–
1348	30	–
1360	20	–
1368/9	–	135
1370	20	–
1380	13	–
1390	20	–
1400	33	–
1404	–	186
1410	60	–
1420	57	–
1430	57	–
1440	94	–
1444	–	140
1450	87	–
1457 (actual)	100	–
1462	–	150

Figures for goldsmiths from T.F. Reddaway and L.E.M. Walker, *The Early History of the Goldsmiths' Company 1327-1509* (1975), 78-81, 90-91, 138-9.

The 1457 figure for pewterers is taken from C. Welch, *History of the Worshipful Company of Pewterers* (1902), i, 20-5, and comprises 56 masters, 34 journeymen and 10 individuals of uncertain status.

appear to average about one tonne of ware per skilled craftsman per annum. The London pewterers of the early 15th century were thus perhaps making some 60 tonnes of ware a year, say 200,000 individual items of domestic pewter. The sizes of individual pewterers' shops, based on information from the Pewterers' Company archives, are given in Table IV.[64] Journeymen's wages are indicated by an isolated figure of 40*s*. a year in a will of 1451,[65] and in 1538 they received between 2*d*. and 4*d*. a day, presumably in addition to board and lodgings.[66]

64 See C. Welch, *History of the Worshipful Company of Pewterers*, 2 vols (1902), i, 20-25.

65 S.L. Thrupp, *The Merchant Class of Medieval London* (1948), 114, citing the will of John Paris.

66 'The Namys of all Clothing, Yeomandry and the Howseholders...', London, Guildhall Library, MS 22,179.

TABLE IV

Size of Pewterers' Shops in London in 1457

Master alone	18	32%
Master + one	11	20%
Master + two	15	27%
Master + three	7	12%
Master + four	1	
Master + six	1	
Master + eight	1	
Master + eleven	1	
Master + eighteen	1	

The largest shop, that of Thomas Dounton, who was also a mercer, comprised eleven apprentices and seven journeymen and is the largest enterprise so far discovered for any craft at that period.

The contents of a London pewterer's workshop of 1427, extracted from the inventory of Thomas Filkes,[67] include everything needed for casting, hammering, soldering, finishing and weighing the ware:

a small charger mould of brass, weight 80 lbs., value 26*s.* 8*d.* at 4*d.* per lb.
a middle platter mould of brass, 54 lbs., 18*s.*
a small platter mould of brass, 59 lbs., 19*s.* 8*d.*
a great dish mould, 50 lbs., 16*s.* 8*d.*
a counterfeit dish mould, 51 lbs., 17*s.*
a middle dish mould, 37 lbs., 12*s.* 4*d.*
a hollow dish mould, 20 lbs., 8*s.* 4*d.* (*sic*)
a greater saucer mould, 16 lbs., 7*s.* (*sic*)
a middle saucer mould, 16 lbs., 5*s.* 4*d.*
a small saucer mould, 16 lbs., 5*s.* 4*d.*
a dish mould and a saucer mould, 25 lbs., 8*s.* 4*d.*
a hollow platter mould, 57 lbs., 19*s.*
a great charger mould, 120 lbs., 44*s.* (*sic*)
a new charger mould, 93 lbs., 31*s.*
a middle charger mould, 106 lbs., 35*s.* 4*d.*
the greatest charger mould, 157 lbs., 52*s.* 4*d.*
14 'prynts', 155 lbs. at 2*d.* the lb., 27*s.* 4*d.*
7 pairs of 'clammes', 60lbs., 5*s.* 6*d.*
a wheel, an arbour and a 'tower' (i.e. a lathe and fittings), 3*s.* 4*d.*

67 Corporation of London Records Office, Letter Book K, f.49r.

Fig. 26 A pewter plate, probably 15th century, from the Thames at London. Diam. 270 mm. (*Museum of London*)

Fig. 27 A pewter saucer from Tong Castle with the mark of a pewterer's hammer on the rim, *c.* 1400. Diam. 137 mm. (*Pewterers' Company*)

a pair of clipping shears, 12*d.*
a burnisher, 2*d.*
8 turning hooks (i.e. lathe tools), 8*d.*
4 anvils and 2 swages, 3*s.* 4*d.*
7 'cleue' hammers, 2*s.* 4*d.*
2 scoring 'flotes', 12*d.*
2 chisels and a pair of lifting tongs, 8*d.*
2 bellows, 2 casting pans and a stirring staff, 8*d.*
4 soldering irons and 3 casting 'stocks', 8*d.*
4 'strake stones' and scales and weights, 21*s.* 3*d.*
20 marking irons, 6*d.*

The moulds listed would have cast saucers, plates and dishes between 4 inches and 20 inches in diameter[68] (Figs. 26, 27); they had a total value, at 4*d.* the lb., of over £16. Each was designated to be shared between from two to six pewterers, and other records also speak of the practice of sharing these expensive items. The will of John Childe (1441)[69] refers to 'my part of a dish mould which I and John Hulle, pewterer, share', and a further complex sharing arrangement was made by the Pewterers' Company in 1448.[70]

From apparently humble beginnings a few decades earlier, by the mid 14th century many London pewterers were acting as merchants, being involved in the shipping of tin from Cornwall and in the exporting of pewterware. In 1364 a ship

68 R.F. Michaelis, *Antique Pewter of the British Isles* (1955), 15-16, for a list of sizes dated 1438.
69 Guildhall Library, London, MS 9171/4, Commissary Court Wills, f.92v.
70 Guildhall MS 7086/1, flyleaves.

owned by a consortium of London pewterers and carrying some 40 tonnes of tin was seized by the French[71] and in 1407 the pewterer John Megre is described as a merchant when he was sued for the delivery of 139½ cwt. of tin worth £150.[72] The prosperity of John de Hilton, pewterer, is indicated by the theft from him in about 1352-4 of gold, silver, amber, precious stones and cloth worth £30 14*s*.[73] In 1345 Nicholas le Peautrer of Ludgate bequeathed to his son his moulds and tools together with 2,000 lbs. of pewter (or tin, *stagnum*), an enamelled cup, silver spoons, mazers and ten marks of silver.[74] Evidence from over 40 London pewterers' wills provides a picture of a close-knit and generally prosperous community.[75] A number of them were summoned from time to time to assemblies of 'the wealthier and wiser commoners', and the craft paid 100*s*. in 1363 towards 'a present sent to the king'.[76] The trade was sufficiently buoyant in the late 14th century to attract craftsmen from the provinces. In 1397 James Quarrer (also Quarry) and John Seward had left the manor of Arlesey (Beds.) to work as pewterers in Candlewick Street, and Quarrer became affluent enough to purchase his own and his son's manumission.[77]

The Pewterers' Ordinances of 1348 stipulate two different pewter alloys, 'fine metal' and 'lay metal'. The former was an alloy of tin with copper and the latter of tin with lead. The lead alloy was in common use in Europe, but the London pewterers sought to conceal the exact nature of the fine metal, on which the high reputation of English pewter abroad rested. Thus the ordinances state only that 'the proportion of copper to the tin is as much as, of its own nature, it will take'. Lay metal is openly defined as 'an hundred' of tin to 26 lbs. of lead.[78] Modern analysis of fine metal reveals alloys of typically 1-3 per cent copper.[79] The harder fine metal was to be used for flatware such as plates and for wares classified as 'square', while lay was to be used for round wares. Quality control was enforced: 23 pottel pots and 20 saltcellars of leady metal were seized from John de Hilton in 1350 and a hand-basin from John Syward in 1373.[80]

Exports of English pewter are first recorded in 1307 with a shipment of about 50 lbs. weight of pitchers, plates and salts, but they rose rapidly to average 15-20 tonnes per annum by 1400, 45-50 tonnes by the 1430s and (exceptionally) 90 tonnes in 1466-7.[81] Indeed, at this time, pewter ranked second only to cloth among manufactured exports. In England, pewter is increasingly mentioned in wills and inventories during the 14th century. Twelve plates, 12 dishes, 18 saltcellars and 2 flagons valued

71 *Cal. of Letters ... of the City of London*, ed. R.R. Sharpe (1885), 96, No. 207.
72 *Cal. Plea & Mem. R., 1381-1412*, 285, 287.
73 *Cal. of Letters*, as note 71, 63, No. 138.
74 *Cal. Hustings Wills*, i, 502, supplemented from the original.
75 D.W. Hall, 'Some Early London Pewterers'; R.F. Homer, 'Medieval London Pewterers'; R.F. Homer, art. cit. note 63.
76 *Cal. Letter-Book G*, 172.
77 Beds. County Record Office, Arlesey Bury Manor Court Roll, IN58; see also Joyce Godber, *History of Bedfordshire* (1969), 101.
78 A later transcript in the Pewterers' Company records gives 22 lbs. of lead.
79 R. Brownsword and E.E.H. Pitt, 'X-ray Fluorescence Analysis of English 13th-16th Century Pewter Flatware', *Archaeometry*, xxvi (1984), 237-44.
80 Riley, *Memorials*, 259-60 and *Cal. Plea & Mem. R., 1323-64*, 264.
81 Hatcher and Barker, *A History of British Pewter*, 64-6.

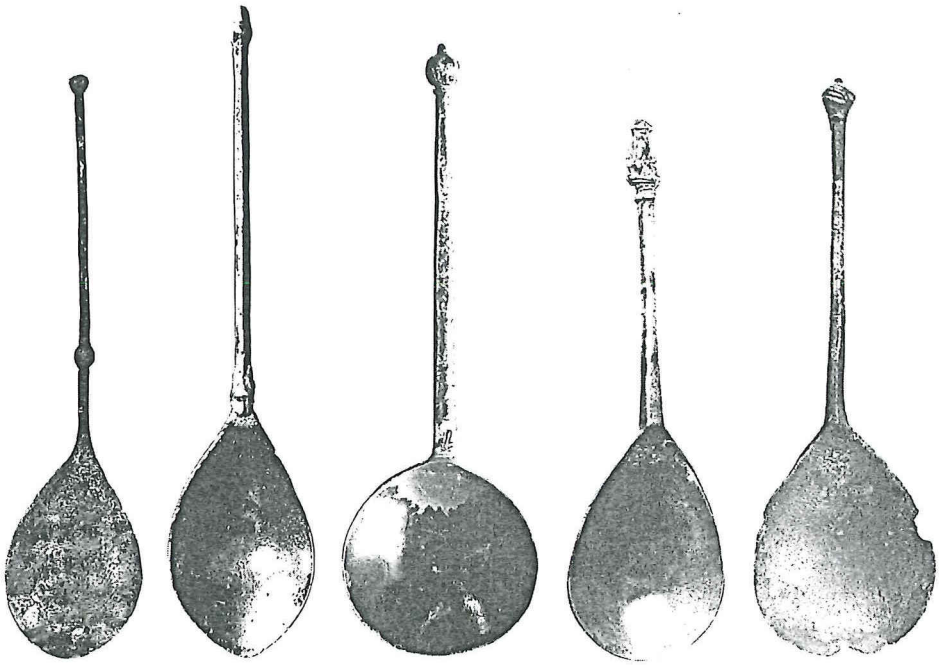

Fig. 28 Five pewter spoons. *Left to right*: *c.* 1300; *c.*1300; 14th century; 15th/16th century; 15th/16th century. Not to uniform scale, *c.* 150-165 mm.

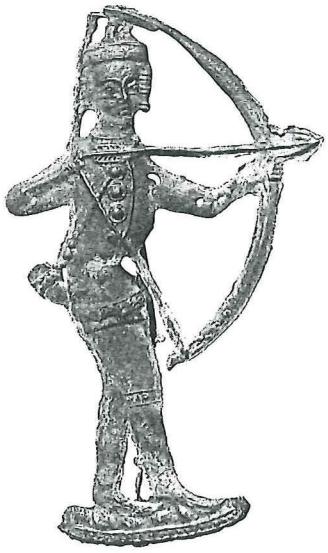

Fig. 29 A pewter badge of an archer, early 15th century, 72 mm. (*Museum of London*)

Fig. 30 A superbly detailed pilgrim souvenir in the form of a pewter ampulla cast with the figure of St. Thomas of Canterbury. From Trig Lane, London, mid 13th-century. Height 97 mm. (*Museum of London*)

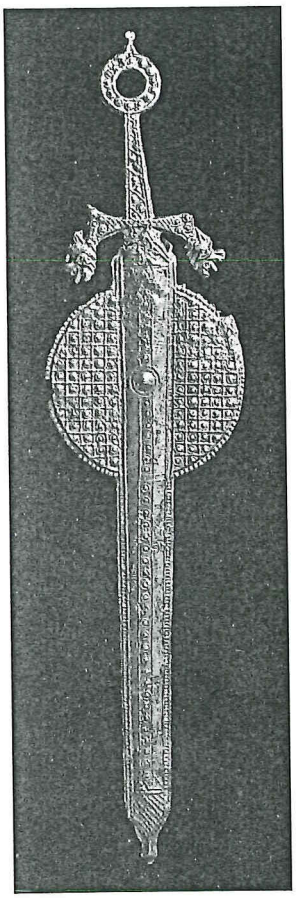

Fig. 32 A pewter seal-matrix with the legend ·S'. BEATRICIS FIL HUGONIS, late 13th century. Max. dimension 40 mm. (*Museum of London*)

Fig. 33 A group of 13th-century tokens in eutectic tin-lead alloy. From the Thames at London. Diam. *c.* 16 mm. (*Private collection*)

Fig. 31 A pewter pilgrim souvenir in the form of a scabbard containing a separate sword and symbolising the martyrdom by the sword of St. Thomas. From Trig Lane, London, before *c.* 1440 and probably late 14th century. Almost certainly a metal mould would have been needed for such a sophisticated product. Height 145 mm. (*Museum of London*)

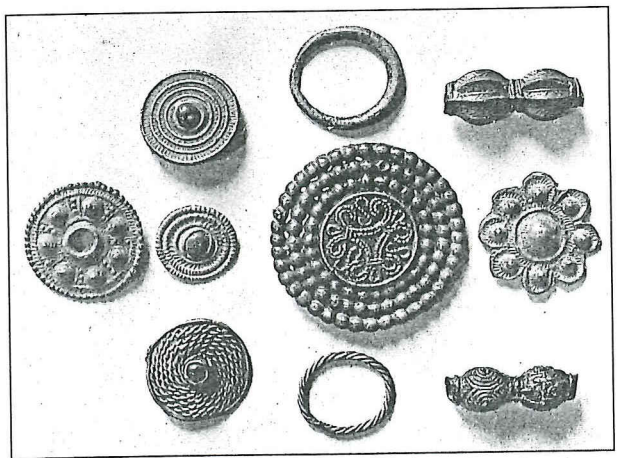

Fig. 34 Jewellery of the 10th or 11th century from London. (*Museum of London*)

Fig. 35 Two pewter finger-rings of 13th- or 14th-century date from the Thames foreshore, London. (*Private collection*)

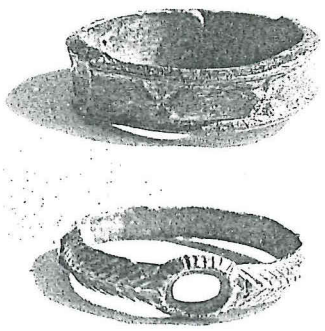

Fig. 36 The lid of a lady's mirror-case, pewter, early 14th century. Diam. 53 mm. (*Museum of London*)

Fig. 37 A 13th-century pewter sepulchral chalice from a grave at Lincoln Cathedral. (*Lincoln Cathedral*)

Fig. 38 A hexagonal pewter cruet from Tong Castle, late 14th century. A very similar cruet was excavated at Ashby-de-la-Zouche. The body appears to have been cast in one piece and the base inserted. (*Tong church*)

Fig. 39 A pewter receptacle, probably a chrismatory, with cast relief decoration on the lid including scenes of the Annunciation and Visitation and the arms of England and France; early 14th century. Height 90 mm. (*Victoria and Albert Museum*)

Fig. 40 A pewter lidded baluster-shaped measure of two pints capacity. The base is inset with a medallion of a heart in a decorative surround. Second half of the 15th century; from the Thames at London. Height overall 211 mm. (*Private collection*)

Fig. 41 A cast pewter crucifix figure, *c.* 1160-70, from Ludgvan church (Cornwall). The alloy is 68% tin, 32% lead, and the figure was originally painted over a gesso ground. Height 126 mm. (*British Museum*)

at 7*s.* appear in the 1317 will of Richard de Blountesham.[82] An inquisition at Wolverhampton in 1341 found that Thomas de Arleye and William de Marnham each had 24 pewter dishes and 12 saucers worth 4*s.*[83] In 1356 Stephen de Northerne, ironmonger of London, had 20 lbs. of pewter valued at 2*s.* 11*d.*;[84] 50 years later John Oliver, draper, owned 200 pieces weighing 400 lbs. and valued at 2½*d.* per lb.[85]

Both pewter and lead were of little intrinsic value and small items such as spoons, badges and tokens, when lost, were not worth retrieving. These have been excavated in large numbers. The earliest pewter spoons date from the end of the 13th century[86] and pilgrim badges in tin, lead and pewter survive from a century earlier (Figs. 28-31).[87] The production and sale of many millions of these badges was a profitable business and the church sought to monopolise it, though apparently with limited

82 Riley, *Memorials*, 123-5.
83 *Cal. Inquisitions Misc., 1307-49*, No. 1758.
84 Riley, *Memorials*, 283.
85 *Cal. Plea & Mem. R., 1413-37*, 4; other wills and inventories are given in Hatcher and Barker, op. cit. and in Homer, op. cit. note 63.
86 R.F. Homer, *Five Centuries of Base Metal Spoons* (The author, 1975); see also S. Muldoon and Roger Brownsword, *Pewter Spoons and other Related Material* (City of Coventry Leisure Services, n.d. [?1985]).
87 Brian Spencer, 'Medieval Pilgrim Badges', in J.G.N. Renaud (ed.) *Rotterdam Papers: A Contribution to Medieval Archaeology* (1968), and 'Pilgrim Souvenirs from Trig Lane', *Trans. London & Middlesex Arch. Soc.* xxxiii (1982).

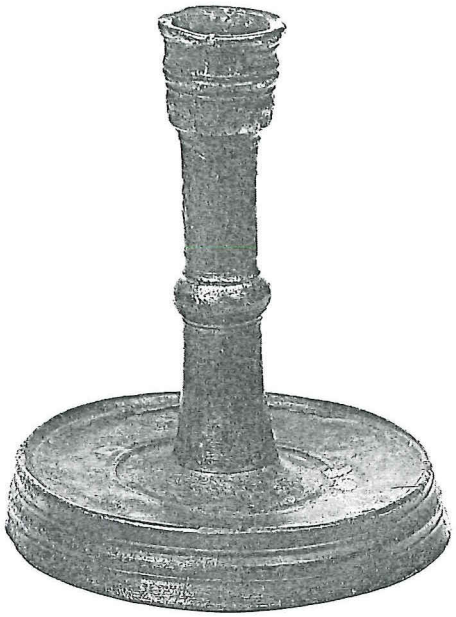

Fig. 42 A pewter candlestick cast in one piece with a hollow stem, probably early to mid 15th-century. From the Thames at Queenhithe. Height 100 mm. Analysis (%): Sn, 78.5; Pb, 20; Cu, 1.29. (*Museum of London*)

success.[88] The large-scale production of pilgrim badges may well have led to the first introduction of metal moulds, for their advantage in preserving the fine detail found on many badges is self-evident.[89] They were perhaps cut by seal engravers (Fig. 132). A token coinage bearing naive designs of animals, birds, human figures and heraldic and geometric designs was produced from *c.* 1200 onwards.[90] Before *c.* 1350 these tokens were cast in eutectic tin/lead alloy and later in lead alone. A few of the earliest are of pure tin (Fig. 33). A considerable quantity of pewter jewellery exists, some of late Anglo-Saxon and Viking date, as do finger rings and dress ornaments (Figs. 34-36). These last were the subject of a complaint by the Girdlers of London in 1327-9 who sought to ban girdles garnished with 'false work of lead, pewter and tin'.[91] In York, in 1427, John Lyllyng was convincted of supplying 'false tin' adulterated with lead to the city's girdlers for making into girdle decorations.[92]

Larger items, which wore rapidly due to the softness of the metal, were readily recast, and at least in the case of pewter records show that the recycling was well organised, old metal fetching about two-thirds the price of new. Thus the survival of significant items is rather rare. In pewter, sepulchral chalices and patens,

88 Idem, 'Medieval Pilgrim Badges', 141.

89 Ibid. 146, note 26; Thomas Hugo, 'Pilgrim Signs', *Archaeologia*, xxxviii (1860).

90 Michael Mitchiner and Anne Skinner, 'English Tokens', *British Numismatic Jnl.* liii (1984). This paper also contains analyses of the metal of tokens and pilgrim badges.

91 *Cal. Patent Rolls, 1327-30*, 40, 367, 379; see also E. Smirke, 'On the Use of Tin in Girdles in the 14th Century', *Arch. Jnl.* ix (1852), 281-4.

92 J. Raine, 'An Account of the Proceedings in a Remarkable Case of Adulteration at York', *A Volume of English Miscellanies...* (Surtees Soc. lxxxv, 1888 (1890)), 1-10. He also traded in 'false iron' and 'false alum'.

deliberately interred with the priest from the 11th century onwards,[93] have been recovered in some numbers from graves (Fig. 37). Other ecclesiastical items include cruets, some elaborately decorated with relief-cast motifs (Figs. 25, 38), a chrismatory (Fig. 22) and a 12th-century cast pewter crucifix figure (Fig. 41). Of domestic items there survive a range of saucers and plates, a few flagons of uncertain provenance, even fewer baluster-shaped wine measures from the end of the medieval period (Fig. 40) and isolated examples of other utensils (Fig. 42). Of the vast and diverse output of the medieval pewterers of England, all that remains today is a random sample of just a few of their products.

Acknowledgements

The author is indebted to Roger Brownsword and Ernest Pitt for permission to quote their analytical results on the objects shown in Figs, 24, 25 and 42.

Further Reading

The most comprehensive work on the tin industry is John Hatcher's *English Tin Production and Trade before 1550* (1973). Earlier studies include G.R. Lewis's *The Stannaries* (1908) and 'The Stannary of Tavistock' which forms chapter 7 of H.P.R. Finberg's *Tavistock Abbey* (1955). L.F. Salzman's 'Mines and Stannaries' in J.F. Willard et al. (eds.), *The English Government at Work 1327-36*, iii (1950) provides much detailed information for the decade which it covers. T.A.P. Greeves, 'The Archaeological Potential of the Devon Tin Industry' in D.W. Crossley (ed.), *Medieval Industry* (C.B.A. Research Rep. xl, 1981) discusses surviving archaeological remains. The same publication contains I.S.W. Blanchard's 'Lead Mining and Smelting' which analyses a wealth of recently-discovered information. Salzman's earlier study in *English Industries of the Middle Ages* is nevertheless still very informative. Early mining and metalworking in general are well described in volume 2 of C. Singer (ed.), *A History of Technology* (1956).

John Hatcher and T.C. Barker, *A History of British Pewter* (1974) contains much of value on the medieval period. Welch's detailed *History of the Worshipful Company of Pewterers*, 2 vols. (1902), based on the Company's records, refers to little before 1451. Descriptions of medieval pewterware are, in general, scattered in the archaeological literature. Spoons are covered in the present author's *Five Centuries of Base Metal Spoons* (1975) and pilgrim badges in several papers by Brian Spencer (see

93 The earliest appears to date from 1087, see *Proc., Soc. of Antiquaries*, 2nd ser. xxii (1909), 394. Thirteenth-century chalices and patens at Lincoln cathedral are illustrated and described by R.F. Homer, 'Chalices and Patens at Lincoln Cathedral', *Jnl. of the Pewter Soc.* vi (1986).

bibliography). Works on pewter which contain some mention of medieval wares include R.F. Michaelis, *Antique Pewter of the British Isles* (1955) and (for continental pewter) H.H. Cotterell, *Pewter Down the Ages* (1932). *Pewter, a Celebration of the Craft, 1200-1700* (Museum of London, Exhibition catalogue, 1989) contains much of value. Decorative leadwork is dealt with in G. Zarnecki, *English Romanesque Lead Sculpture* (1957).