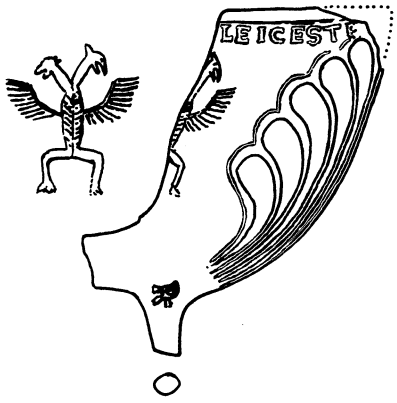
The Clay Tobacco Pipes from Causeway Lane, Leicester



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Roman and Medieval Occupation in Causeway Lane, Leicester

Excavations 1980 and 1991

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THE CLAY TOBACCO PIPES

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Introduction

The 1991 excavations produced 6,328 fragments of pipe (770 bowl, 5,246 stem and 312 mouthpiece fragments) from fifty-two different contexts. The number of pipes recovered is disproportionately large in relation to the number of excavated contexts because two of the contexts contained dumps of kiln waste, one of which was particularly large. These dumps not only produced significant numbers of pipes but also important evidence for the nature and form of the kilns in which they were fired (Peacey, below). These kiln groups are the first to have been excavated from the county and provide a wealth of new information about the styles of pipe which were being made and the technology that was employed to produce them. These groups were clearly of more than local interest and warranted detailed study. For this reason the report is divided into sections; the first deals with the contexts which contained purely domestic groups of pipe. This section also deals with residual or intrusive pieces from the kiln groups. The two groups of pipes from the kiln dumps are then presented followed by a detailed analysis and discussion of the kiln waste. Documentary information regarding the site and pipemakers is presented by P. J. Hammond below.

All of the pipe fragments have been examined, catalogued and context summaries produced using the recording system developed at the University of Liverpool. Copies of these detailed lists have been deposited in the site archive. This report presents a more general synthesis and discussion of the finds.

The domestic pipes

Apart from the two kiln groups, 277 fragments of pipe were recovered from 50 contexts, an average of 5.5 fragments per context. There were 40 bowl, 232 stem and 5 mouthpiece fragments ranging from the 17th to the 19th century in date. Only eight of the groups contained ten or more pieces of pipe and the largest group contained just 36 fragments. Although these pipes provide some dating evidence for the post-medieval deposits the small size of the groups limits their reliability. The small number of diagnostic pieces in any context also limits the information which can be derived regarding the currency and evolution of local pipe styles.

The pipes recovered fit within the broad pattern which has been established for the city (Higgins 1985) with the addition of some interesting new forms and detail (figs. 98.1-15). The earliest closely datable pieces date from the 1640's, some sixty or seventy years after the introduction of smoking to this country. By the mid-17th century a 'Midlands spur type' (Higgins 1985, 291) had become established and this continued to be the principal form used in Leicester until the end of the seventeenth century. The evolution of this type is represented by a number of examples from the excavation (figs. 98.1-8).

The spur bowls are generally of good form and neatly finished. Despite this, one of them has a very uneven and 'lumpy' surface formed by irregularities in the surface of the mould. These are most unusual and appear as a rash of small raised bumps on both sides of the bowl (fig. 98.1). This example is fully milled unlike the other examples which tend to be only half-milled on the side facing the smoker. The latest example, dating from *c.*1680-1710 (fig. 98.8), is not milled at all. A second example, from the same context and made in the same mould, has a quarter-milled rim facing the smoker. The spur pipes from the excavation reflect a decline in the use of milling from the first half of the 17th century, when pipes were generally fully milled, to the end of the century, when milling was abandoned altogether.

Two spur pipes, figs. 98.3 & 4, were recovered from context 2301. This is one of the 'larger' groups containing ten fragments and which appears to date from *c.*1660-80. The occurrence of these bowls in the same context provides an indication of contemporary styles. The same applies to figs.98.7 and 8 which are two of the bowls recovered from a group of 36 pieces in context 374; a group which appears to have been deposited *c.*1680-1710. Both of these later bowls have been internally knife trimmed, to give a finer edge to the bowl, and then bottered to give a smooth finish. This has caused a slight internal lip to form inside the bowl rim. This finishing technique appears to be characteristic of late 17th to early 18th century pipes.

As noted above, two bowls from the same mould were recovered from context 374, one of which was milled and one of which was not (fig. 98.8). Another difference between these bowls is that the illustrated example has a stem bore of $^{6}/_{64}$" while the other example has a bore of $^{7}/_{64}$". A piece of stem also fits the unillustrated example and this has an uneven bulge in it, suggesting that the stem became damaged and was repaired during the manufacturing process. These features demonstrate that differences in workshop practice occurred and show how they could affect the appearance and attributes of the finished product.

During the late 17th and early 18th century radical changes in fashion took place. The Midlands spur type fell from favour to be replaced by a new range of heel forms, an unusual example of which is a Broseley style of pipe, dating from *c.*1680-1730 (fig. 98.9). Broseley, in Shropshire, became a major pipe manufacturing centre which generated distinctive styles of its own (Higgins 1987). The 'Type 5' form (Atkinson 1975), with its large, tailed, heel is perhaps the most distinctive product of this centre. The example from Causeway Lane has an incuse stamped initial mark on the base, which, on the basis of a more complete example from elsewhere in Leicester, is likely to have read IW or LW (Green 1984, fig. 24). There is another example of either a Broseley type 3 or type 5 bowl from Stanhopes Field, High Cross near Lutterworth (Jewry Wall Museum; fieldwalking collections) which is certainly marked IW. Although the Causeway Lane example is in a Broseley style the lack of a burnished surface, the use of an incuse initial mark, which was not used at Broseley, and the occurrence of other examples from Leicestershire all point to its being a local copy.

During the eighteenth century more upright, thin-walled bowls were in fashion. The bowls of these pipes are much more fragile than the thick 17th century styles and they survive poorly in the archaeological record. A good example was, however, recovered from context 2755. This has a well proportioned bowl with a simple cut rim and an internal bowl cross (fig. 98.10). Two fitting pieces of stem give a surviving stem length of 14cm. This is all plain, almost certainly indicating that the pipe was not marked or decorated. The stem bore is surprisingly small, being only $^{4}/_{64}$" in diameter. There is a similar damaged bowl from context 2162 which has a stem bore of just over $^{4}/_{64}$". This example does not have an internal bowl cross.

There are three stems, dating from *c.*1760-90, with Midlands style stem borders on them (figs. 98.11-13). This particular pattern of decoration was used by makers from as far apart as Chesterfield and Cambridge (Walker & Wells 1979, 9). Two of the Causeway Lane examples also have maker's stamps, showing them to have been made by John Ward of Derby. It is interesting that Ward should have found a market in Leicester since pipes usually do not move far from their place of manufacture. Similar decorated stems were produced in Nottingham and a few of these have also been found in Leicester (for example, Green 1991, fig. 4). It seems highly probable that the Leicester makers would also have used this type of decorative stem border although most of the borders found in the city do not have names on them and none of those that do has yet been linked to a known Leicester maker.

At the same time that decorated stems were being produced moulded bowl decoration became popular. One of the earliest common motifs to be used consisted of scalloped decoration, one example of which was found amongst the domestic material (fig. 98.14). This piece is particularly interesting since it also has a moulded eagle facing the smoker and the maker's name and LEICESTER moulded in relief around the rim. Unfortunately the maker's name is not clear, although it possibly reads FLUDE with a small fleur-de-lys at the end. A John Flude, son of John Flude of Leicester, labourer, was apprenticed to the pipemaker Henry Headley in 1738 and took his freedom in 1754 (Hartopp 1927, 310 & 435). He is known to have worked in Leicester until 1768 (Gault 1979, 373). Another excavated example of this bowl is known from the garden of Castle House in Leicester, but with a damaged rim so the name is missing (Leicester Museum, A17.1986 U/S). There is also a bowl in the Jewry Wall Museum with fluted decoration and .....E / LEISTER (sic) moulded around the rim (Acc. No. A185.1966.12). The spur of this pipe is marked IF. The last letter of the surname together with the initials strongly suggest this can also be attributed to John Flude. The use of moulded rim lettering is characteristic of pipes produced in Lincolnshire and Nottinghamshire where the style is likely to have evolved during the 1760's or 70's (Walker & Wells, 1979). These pieces clearly show that the style was also being used in Leicester at an early date. It also means that Leicester can be added as a new production centre at the southwesterly limit of the core production area (Walker & Wells 1979, fig. 9).

The other mould decorated fragments are of 19th century date and consist of a small rim sherd with leaf decorated seams from context 542, a spur pipe fragment with leaf decorated seams from context 1293 (fig. 98.15) and four decorated pieces from context 2000, all of which can be mould matched with examples from the kiln waste (1 example of fig. 100.28; 3 examples of fig. 100.29). From the kiln waste there is also one decorated piece which is clearly intrusive. This consists of a bowl fragment with traces of a standing figure above a scroll containing lettering (fig. 100.30). The lettering appears to read SHERR.. / ..AIN. This almost certainly represents a pipe made by Edward Sherry of Gainsborough who is recorded working from 1792-1820 and who died in 1822 (Wells 1979, 138).

Even including the Sherry pipe and one of the John Ward pipes, both of which came from one of the kiln groups, a total of only five marked pipes were recovered from amongst the domestic material. These were pipes made by IW, Flude of Leicester, Sherry of Gainsborough and two by Ward of Derby. Of these, three are certainly imports to the city in addition to which the IW pipe may well be, leaving only the Flude pipe as a local product. This underlines the low level of marking amongst the Leicester pipemakers and emphasizes the importance of good pit groups or kiln groups from which the local typology can be established and refined. There were also very few decorated pieces recovered. This is principally due to the lack of more recent domestic contexts which are likely to have contained this type of material. Although the excavation produced a relatively small quantity of domestic material it has still provided some important new information about the local industry, in particular by establishing Leicester as a production centre for pipes with moulded rim lettering.

The first kiln group

(Context 2358; figs 98.13 and 99.16-100.32)

The largest, and most significant, group of kiln waste was recovered from context 2358, the bedding layer for a brick cellar floor. This provided a well sealed context with little risk of contamination from either the layers through which the cellar had been cut or from later disturbance. The deposit included large quantities of kiln debris from a muffle kiln (Peacey, below) as well as numerous pipes, many of which showed clear signs of being wasters. A significant proportion of the bowls were intact which, together with the survival of long stem fragments, suggested that this was a 'fresh' deposit of waste rather than a redeposited one. A total of 5,839 fragments of pipe were recovered, consisting of 654 bowl, 4,886 stem and 299 mouthpiece fragments. This does not include pipe fragments still embedded within kiln waste.

Despite the clear and well sealed evidence for a pipe kiln in the area both the origin and dating of the material has proved to be a problem. Initially it was hoped that the pipe kiln might have actually been on the site and that the date of the deposit could be determined from maps and deeds relating to the construction of the cellar. Documentary research, however, did not produce any evidence for either a pipemaker or kiln on the site (Hammond, below). It also failed to locate any building which could be related to the excavated cellar. The first detailed map of the site is the 1st Edition 25" O.S. map of 1887 which shows the site of the cellar occupied by a building fronting onto Countess Street. The cellar, however, does not appear to be related to this building, the building plans for which suggests that it was constructed in about 1866 as Countess Street was being laid out. The style of the pipes clearly indicated an early 19th century date for the deposit and so an earlier building had to be searched for.

Combe's map of 1802 only depicts the buildings of Leicester as general blocks. One such block is depicted at the junction of Causeway Lane but fronting onto East Bond Street. This is fairly well to the east of the cellar and on a different alignment so it seems unlikely that these buildings relate to the cellar. In this case the map provides a *terminus post quem* of 1802 for the deposit. By 1828 Fowler depicts a row of housing along the north side of Causeway Lane with strip gardens running back behind them. These are on the same orientation as the cellar which seems likely to have been in one of these, presumably beneath some sort of outbuilding. If the outbuilding were contemporary with the development of the north side of Causeway Lane then this would give *terminus ante quem* of 1828 for the waste.

On archaeological grounds there are a number of factors which support and help refine these suggested dates. The group contains a number of pipes, including wasters, which are marked RK. These can be attributed to the Leicester maker Richard King, who was pipemaking by 1805 and who died in 1828 (Hammond, below). This confirms the *terminus ante quem* of 1828, suggested by the cartographic evidence. In addition there is a single marked piece which can be attributed to Edward Sherry of Gainsborough who is recorded working from 1792-1820 and who died in 1822 (Wells 1979, 138). Since pipes had a very short life expectancy this suggests that the terminal date of the deposit can be pushed back to *c.*1822. On stylistic grounds the use of foliage sprigs on the stems of some of the pipes indicates a date in the second decade of the

19th century or later. The pottery includes pearlwares and transfer-printed earthenwares of a similar date. Taken together this evidence strongly suggests a date of *c.*1810-20 for this material, with the preferred date of deposition being around 1820. This close dating together with the sealed nature of the deposit is important in that it provides a chronological bench mark against which other groups of pipes and pottery from the region can be measured.

In determining the origin of the pipe and kiln debris, the key pieces are the waste pipes marked RK which must have originated in King's workshop. These pipes only constitute a small proportion of the pipes recovered but it seems unlikely that a single sealed foundation deposit would have been made up of waste from more than one different production site. As a result this group must be seen as waste from King's workshop, representing a sample of his production range from the second decade of the nineteenth century. By this time King was working at the western end of Belgrave Gate where he stayed until his death in 1828 (Hammond, below). This workshop lay about a quarter of a mile to the southeast of the excavated site.

Treatment of the material

The material was badly affected by iron staining, making it difficult to examine and compare the pieces and impossible to attempt reconstruction. An effective method of removing this staining was found to be an EDTA (ethylenediaminetetra-acetic acid solution). A description of the process used is given by J. Mirdamadi on p.233 below.

The nature of the assemblage was such that it seemed highly likely that complete pipes could be reconstructed. The pieces were systematically sorted and an attempt to reconstruct them made using the methodology described elsewhere (Higgins 1982). It was the junctions between bowls and stems which were principally checked since these are the easiest to find and provide the key to whether sufficient joins are present to allow complete pipes to be reassembled. There were a total of 419 fragments of bowls with stem junctions and 292 stems which were opening out into bowls. Of these only twenty stem to bowl joins were found; a success rate of only 6.8%. This was a disappointingly low rate and suggested that a lot of material was missing from the assemblage. Given that there were about 5,000 pieces of stem and mouthpiece for the 419 bowl junctions each stem must have been broken into about 12 pieces. With a potential success rate of only 6.8% for each successive join it was most unlikely that any complete pipes could be reassembled and so the attempt was abandoned.

The material was then sorted into different bowl forms and an attempt made to identify the number of different mould types represented. This was relatively easy with the decorated bowls but much more difficult with the plain bowls which had to be matched by reference to small mould flaws. These occur most frequently around the spur or heel of the pipe. With the exception of about twenty very fragmentary pieces all of the bowl stem junctions were mould sorted, but the majority of the plain bowl fragments could not be attributed. This was in contrast to the decorated fragments which could easily be recognised. For this reason the minimum number of each type represented was also recorded. For the two largest groups the minimum number was based on the number of bowl/stem junctions so that the two figures are comparable. For features such as stem bore and finishing techniques only a sample of the two large groups were examined.

A total of seventeen different mould types were identified; a summary of the attributes of each type is given in Table 61, followed by a more detailed description of each type. This is followed by a discussion of the workshop practices represented.

The mould types represented

Almost all of the bowl/stem junctions and all of the decorated fragments could be sorted into individual mould types. A total of seventeen different moulds were identified and these are described below using the figure number for identification.

Fig. 99.16 Plain spur form. The mould is identified by a fine scratch running the full length of the right hand side of the spur and by a series of scratches on the left hand side of the bowl. Several of the examples have evidence of an internal bowl cross, which appears to be tilted slightly to the right. Composite bowl drawing from three of the fragments.

Fig. 99.17 Plain spur form. The mould is identified by a small, oval irregularity and a small scratch on the right hand side of the spur. There are also flaws on the bowl sides but these are less regularly evident. This pipe is also characterised by a distinctive internal bowl mark consisting of a double cross. Almost all of the rims show evidence of having been wiped to smooth them. The wiping is often very light and it can be intermittent.

Fig. 99.18 Plain spur form. This type appears to have a finer spur than the previous examples. It has an internal bowl cross and is particularly distinctive in that there are four pronounced ribs, caused by grooves in the stopper, which occur inside the bowl on the left hand side, away from the smoker. The stem bores of these pipes were both just over $^{4}/_{64}$" but both are

Table 41: ***Summary of bowl forms from context 2358***

Fig. No	No. of frags	Min No. of pipes	No. Smoked	Bowl rims wiped?	Trimmed or flattened heels or spurs	Stem bore range (inches)	No. of wasters
16	6	6	1	Yes	Flattened	$^{5}/_{64}$th	0
17	169	168	8	Yes	Trimmed	$^{5}/_{64}$th	8
18	2	2	0	Yes?	-	$^{5}/_{64}$th	2
19	1	1	0	-	-	$^{4}/_{64}$th	1
20	1	1	0	No	No	$^{4}/_{64}$th	0
21	7	7	0	Yes	No	$^{5}/_{64}$th	2
22	10	10	2	Yes	No	$^{4}/_{64}$-$^{5}/_{64}$th	0
23	12	12	1	Yes	No	$^{4}/_{64}$-$^{5}/_{64}$th	0
24	1	1	-	-	No	$^{4}/_{64}$th	0
25	6	6	1	Some	No	$^{4}/_{64}$th	0
26	1	1	0	-	No	$^{4}/_{64}$th	0
27	2	1	0	-	-	-	2
28	27	13	2	No	Flattened	$^{4}/_{64}$th	?1
29	283	234	5	No	No	$^{4}/_{64}$th-$^{5}/_{64}$th	3
30	1	1	0	-	No	$^{5}/_{64}$th	0
31	1	1	?	-	-	$^{5}/_{64}$th	0
32	1	1	?	-	-	$^{4}/_{64}$th	0

vitrified, which would have resulted in additional shrinkage, so they have been recorded above as 5/64".

Fig. 99.19 Plain spur fragment. This has a forward pointing spur and an internal bowl cross where the rib on the long axis of the pipe is much more pronounced than the lateral one. This pipe had a bore of 4/64" but was vitrified and could originally have been as much as 5/64".

Fig. 99.20 Plain spur form. The spur has a square section to it and there is no internal bowl cross.

Fig. 99.21 Plain heel pipe. The initials are quite neatly executed but with a tail to the leg of the K, which also has a small flaw to the right of it.

Fig. 99.22 Plain heel pipe. The initials are very similar to 21 but without the flaws around the K. The tail of the R tends to be surrounded by a small hollow. Bowl form has flaws on it and is clearly different to 21. Nine of the examples have wiped rims but one may not have been wiped.

Fig. 99.23 Plain heel pipe. The initials are rather poor , the K typically being poorly defined and with the R at an odd angle.

Fig. 99.24 Fragment from a heel bowl with fluted decoration. This may be from the same mould as one from the Austin Friars, Leicester (A389.1973 U/S; SF 1312). This has simple flutes on the bowl but no other decoration or lettering.

Fig. 100.25 Decorated heel pipe. There is a star mark on the heel and a faint foliage frieze above the fluting.

Fig. 100.26 Heel fragment. This is very similar to 25 above but seems to be of a slightly heavier build and without decoration.

Fig. 100.27 Decorated spur pipe, one fragment from the front and one from the back of the bowl. These have been mould matched with a more complete example from Elbow Lane, Leicester (Higgins 1985, fig 90).

Fig. 100.28 Decorated spur pipe. The clay in one of the bowls has been poorly mixed causing it to laminate, particularly at the bowl/stem junction. This may have been the cause of the pipe having been wasted.

Fig. 100.29 Decorated spur pipe. This is a particularly crudely designed mould with poorly designed flutes and a large mould flaw on the right hand side away from the smoker. Small, off centre, internal bowl cross.

Fig. 100.30 Single fragment of a decorated spur pipe having the relief moulded lettering SHERR.. / ...AIN in a scroll with traces of a standing figure above. This can be attributed to Edward Sherry of Gainsborough who is recorded working from 1792-1820 and who died in 1822 (Wells 1979, 138).

Fig. 100.31 Single fragment from a pipe with moulded leaf decoration on the seams. This consists of leaves with small spikes between.

Fig. 100.32 Single fragment from a pipe with moulded leaf decoration on the seams.

Although these seventeen different bowl forms were found together with the kiln waste at least one of them, the Sherry piece, is clearly intrusive to the group. This raises the question as to whether any of the other material is intrusive. Six or seven of the other forms include wasters (types 17, 18, 19, 21, 27, 28 and 29) and these can certainly be seen as part of the kiln group. The other pieces are less certain. Many of them only occur as single examples from which it is almost impossible to draw any firm conclusions. Even with large groups, like the type 29 bowls, it is very rare that kiln wasters as such can be identified. Out of the whole sample of 531 bowls listed above only 19 fragments could clearly seen to be wasters because they were deformed or vitrified; just 3.6%. The main indication that these pipes represented kiln rather than domestic waste comes not so much from their physical shape or condition but from secondary attributes such as whether they have been smoked or not. The majority of the pipes, 96.2%, did not show any sign of having been smoked while only about 20 examples, 3.8%, did so. The fact that such a high proportion of the pipes had never been used provides perhaps the clearest indication that this is a kiln group.

Where only a few examples of a particular mould type occur neither traces of having been smoked nor evidence for being a waster can be used as a reliable indicator. The number of examples present does not provide a reliable indicator either, since types 18, 19 and 21 were only represented by 1 or 2 fragments each and yet all were clearly kiln wasters. Types 31 and 32 occurred as single examples which may have been smoked. If this is the case it is more likely that they are intrusive. All that can really be said of this group is that six or seven of the types clearly represent production waste, very few of the pipes appear to have been smoked and that only one of the contemporary bowls is clearly intrusive. The group did also contain some earlier residual material, such as six 17th century fragments, including a bowl (fig. 98.6), and a piece of 18th century decorated stem (fig. 98.13). These pieces, however, only constitute a very small percentage, 0.1%, of the total and suggest that the risk of contamination to the deposit is very low.

Evidence for workshop practice

One of the most important things about any group of kiln waste is the evidence which it can provide for workshop practice at a given point in time. From the study of such groups it is possible to refine the dating and interpretation of pipes and manufacturing techniques observed elsewhere.

This assemblage is dominated by pipes from two moulds, types 17 and 29. These two types represent 402 of the minimum number of 466 pipes, or 86% of the total. This suggests that not all of the moulds were in use at any one time but that batches of particular patterns were produced to build up stock. Since the press had to be re-set each time the mould was changed it would have made sense to produce a run of pipes before changing to a different mould. It would also make handling easier since the product would be more uniform and there would be less sorting of different types as the kiln was unloaded.

Amongst the mould groups differences were observed which seem to have been pattern specific. The wiping of rims to smooth them after they have been cut with a knife is a case in point. Types 16, 17, 21, 22, 23 and possibly 18 all had consistently wiped rims while types 20, 28 and 29 did not. Only in type 25 did there appear to be a difference with three rims appearing to have been wiped and two showing no sign of wiping. Likewise the finishing of the heel or spur differs from pattern to pattern. In types 16 and 28 the base of the spur has consistently been flattened during the trimming stage. In type 17 it appears to have been properly trimmed with a knife cut. None of the other bowls had been so treated. The bases of the heel types are particularly poor, often exhibiting very rough and irregular mould seams in this area. These finishing differences may reflect the quality or status of the pipes.

Type 29, although decorated, has neither wiped rim nor trimmed spur. This is in contrast to the other common type, 17, which, although plain, has both a wiped rim and a trimmed spur. This plain pipe with its elegant lines and neat finishing would have taken longer to prepare than the crudely decorated and roughly finished type 29 and is likely to have retailed at a higher price. This suggests that the traditional plain pipe may have retained its place at the top end of the market while the crudely produced mould decorated forms were catering for the everyday market. Such a difference in status is likely to have been reflected in stem length.

The longest surviving stems attached to bowls occur on the

type 17 pipes. These do not appear to be straight which suggests curved stems had become established in Leicester by the 1810's. Some of the type 17 pipes have a reverse curve on the stem and partially deformed bowls. These pieces are overfired and have started to collapse in the kiln. The manner in which they have done so confirms the normal stacking arrangement for a muffle kiln at this period with the bowls leaning up at an angle and resting on the edge of the bowl farthest from the smoker (see Peacey, below).

The stem bores of the pipes are generally consistent to mould type although not invariably so. Types 22 and 23 have a mixture of $^{4}/_{64}$" and $^{5}/_{64}$" bores while type 29 had mainly $^{4}/_{64}$" bores with a few $^{5}/_{64}$" ones. These differences suggest that specific moulding and trimming wires were not always kept with each pipe, a pattern which has been noted from other sites but which contrasts with the evidence from the second kiln group (see below). It may be that the specific association of a mould and moulding wire was only occasionally adopted, or that it only emerged with the introduction of shorter moulds around the middle of the 19th century.

A few of the pipes exhibited signs of having been repaired during the manufacturing process. Two of the type 17 and one of the type 28 pipes have spurs which have been 'stuck on' or completely remodelled by hand. Presumably they became detached as the pipes were being taken from the mould and so, rather than waste the pipe, it was pushed back on again by the pipemaker. Evidence for this kind of repair has been noted from the 17th century onwards.

Four of the pieces had a red wax coating from the mouthpiece surviving. Documentary sources suggest that the mouthpieces of pipes were treated with a variety of finishes to prevent the porous clay from sticking to the smokers' lips but only glazed tips tend to survive in the archaeological record. These wax coated pieces not only provide a date by which this medium was being used in Leicester but also indicate that slightly damaged pipes were considered saleable since one of the pieces has the wax coating extending across a broken end. No doubt only a short section was missing but it provides another indication of the slight variability that could be expected from a mould produced product and the fact that, wherever possible, the pipemaker would try to salvage rather than scrap a pipe.

Internal bowl crosses were present in five of the types; 16-19 and 29. These are all spur types, crosses did not occur with any of the heel types.

Discussion of the first kiln group

The bowl forms from King's workshop provide an indication of the range of products which were being produced in Leicester during the 1810's. All of these pipes are likely to have been of the long stemmed type which were typical of the period. There are likely to have been different lengths produced according to the quality and status of the pipe but it has not been possible to gather any information about this aspect. A range of bowl forms was clearly being produced with both spur (16-20, 27-29) and heel forms (21-26) available. Both were produced in plain or decorated styles. The decoration appears to have been confined to a range of fairly simple scalloped or fluted designs, each of which is different in detail.

A group of early 19th century pipes from a site at Elbow Lane, Leicester produced more than one mould type with the same type of decoration. It was postulated that these might represent the products of different makers who were competing by copying one another's designs (Higgins 1985, 300). This suggestion is supported by the kiln group since two of these patterns, 25 and 28, can now be attributed to Richard King. Both of these types were found at Elbow Lane together with similar copies which are not present in the kiln group. This suggests that the matching pairs are the products of another maker competing with King.

The kiln group also shows that King did not mark all of his products. He only appears to have marked the heel pipes, four of which have his initials on while the remaining two have symbol marks consisting of a star. None of the spur pipes are marked. This suggests that marking may have been as much a subject of fashion as anything else. It appears to have been important to have a mark on the sides of a heel pipe, even if this were only a symbol, while such marking was not part of the expected design for a spur pipe.

While this group provides an important sample of King's production range, it is clearly not definitive. A different large plain heel type with the moulded initials RK was found at the Austin Friars site (Higgins 1985, fig. 30), and another version was found at Elbow Lane (Higgins 1985, fig. 122). The Elbow Lane site also produced an RK bowl with leaf decorated seams (Higgins 1985, fig. 123) while from the Austin Friars is a fluted bowl with the initials RK on the spur and LESTER moulded around the right hand side of the rim (Leicester Museum A389.1973, SF 1093). Unfortunately the left hand side of this bowl, which would have had the maker's name on it, is missing. It seems almost certain, however, that this design was produced by King. It provides another example of this style from Leicester, showing that it continued to be used into the 19th century.

The absence of these other known varieties of King's pipes from the kiln group does not necessarily mean that they were not being made at the time. Apart from the two dominant types most of the varieties in the group were only represented by a few, or single, examples. Erratic numbers of types, often with a few forms dominating, have been noted from other kiln groups. This can be explained by the nature of the material. On a production site waste would have accumulated quite rapidly. Some of this would become deposited around the site but the majority, particularly in urban areas, would have to be disposed of on a regular basis. Construction sites requiring hardcore would have been an ideal place where this material could be utilised. The material deposited, however, would only be likely to represent a brief period of rubbish accumulation at the kiln site. The numbers of different patterns contained in the kiln waste and the quantities present will, therefore, have been dependent on the production and handling activities of a short period during which particular types may have been broken in large numbers, or not at all. For this reason the Causeway Lane group can only be regarded as a sample, showing some of the types which were certainly being produced at this time. A series of such deposits will be required before a comprehensive picture of the dating and development of individual styles within the workshop can be arrived at.

The second kiln group (Context 3501; figs. 100.33-101.46)

This group of material was recovered from a general cleaning layer. The comparatively late date and general nature of this context meant that the pipes could easily have been dismissed as being of little consequence. In fact, they provide one of the few good groups of 19th century pipes known from Leicestershire and are particularly important since they represent production debris from another of the city's workshops.

This material can be regarded as a discrete deposit of production waste for several reasons. First, the fragments are generally well preserved, occurring as quite large, un-abraded pieces and with a large number of whole bowls present. There are also a number of cross joins between the fragments. Secondly, a small amount of production waste and kiln debris was recovered with the pipes. This strongly suggests that the pipes come from a kiln site, although waste pipes are notoriously difficult to identify since they rarely show any

physical differences from purely domestic waste. Thirdly, the majority of the pipes show no signs of having been smoked and, in a few cases, the bowls are slightly deformed or otherwise defective. These features, including the presence of a few smoked examples (probably used and discarded by workers at the kiln), are typical of pipes recovered from production sites. Finally, although quite a sizable group there are only twelve basic patterns of pipe represented. Domestic waste usually contains a diversity of forms with little duplication and a high percentage of smoked examples.

The group as a whole consists of 212 pieces of pipe; 76 bowl, 128 stem and 8 mouthpiece fragments. Five of the stem fragments date from the 17th century and are residual but all of the remaining stems appear to date from the 19th century. These have all been considered to form part of the kiln group although where single examples occur, particularly if they have been smoked, it may be that they are stray pieces which should be treated with caution (see below).

All of the 19th century bowls were sorted and an attempt made to reconstruct complete examples of the pipes using the methodology described elsewhere (Higgins 1982). Some bowl/stem junction joins and one mouthpiece/stem join were found but this could not be joined to any other stems. There were no other mouthpiece/stem joins and so no pipes could be completed. The low recovery rate of stem and mouthpiece fragments from this context clearly limited the chances of reconstructing complete pipes.

The bowls were then sorted into types. A careful search for mould flaws was carried out in an attempt to identify the number of individual mould types present. This was possible for the decorated pipes but few distinctive flaws could be found amongst the plain types and so they could only be sorted into general groups.

Twelve basic bowl forms were present within the context and these were lettered A-L. A summary of the information about the twelve bowl types is given in table 42 followed by a more detailed description of each type.

Table 42: ***Summary of bowl forms from context 3501***

Bowl type	Fig. No.	No. of frags	Min No. of pipes	No. Smoked	Internally Cut or trimmed?	Size of Bore (inches)	Stem length	Wasters?
A	33	2	2	1	Yes	5/64th	Long	No
B	34	18	18	5	No	5/64th	Long	No
C	36	8	8	2	Yes	4/64th	Long	No
D	38	1	1	0	No	4/64th	Long	No
E	39	3	2	0	No	5/64th	Short	No
F	40	1	1	0	No	4/64th	Short	No
G	41	1	1	1	No	4/64th	Long	No
H	42	1	1	1	No	5/64th	Long	No
I	43	14	14	2	No	5/64th	Long	No
J	44	4	4	0	No	5/64th	Long	Yes
K	45	3	2	0	No	5/64th	Short	Yes
L	46	3	3	0	No	4/64th	Short	Yes

The mould types represented:

The bowl types present were sorted into twelve groups. Insufficient distinguishing marks could be found for all of these to be mould specific. The types are described below together with a note as to whether or not they are mould specific.

Type A (fig. 100.33); These pipes could not be mould matched from identifiable flaws although the close similarity of form suggests that they are almost certainly from the same mould. Both examples have been internally knife trimmed at the rim but not wiped. This particular bowl form is characteristic of the long-stemmed 'churchwarden' pipe and is likely to have been the most expensive type produced. The form can be closely paralleled amongst the products of the Broseley industry (Higgins 1987, fig. 22.9h), which was famed for its long-stemmed pipes, although the products from there often had wiped rims.

Type B (fig. 100.34); Although these could not be mould matched through flaws the bowls are all very similar in form. One of the smoked examples, with a damaged bowl, may be slightly different but the others are all likely to come from the same mould. All of these pipes have simple cut rims without any evidence of internal trimming or wiping. Just one of these bowls is marked with an incuse, sans serif mark reading CHENNERY LESTER (fig. 100.35). This is the only known example of this maker's mark.

Type C (fig. 101.36); This group can be sub-divided into those with plain spurs (fig. 101.36) and one example which has a small mould mark on the right hand side (fig. 101.37). No other mould flaws have been identified within this group and so it is impossible to be sure whether this mark represents a different mould or simply the same mould which was later damaged or had this dot added intentionally. All 8 bowls are of very similar form with a more slender, elegant bowl than type C and a thinner stem. The stems of this type are about 6.5mm wide and 8mm deep just behind the bowl as opposed to 8mm wide and 9mm deep in type C. The bowls also differ from type C in that they all have stem bores of 4/64" and internally trimmed rims. The example with the dot also appears to have had the rim wiped, lending weight to the argument that it represents a different mould.

Type D (fig. 101.38); Single example of a small bowl with a tiny spur and thin stem. Simple cut rim.

Type E (fig. 101.39); One of the two examples is damaged and the bowls cannot be positively mould matched. The one surviving rim has simply been cut. These would probably have been short-stemmed 'cutty' pipes.

Type F (fig. 101.40); The angle of the surviving stem bore suggests that the stem was quite sharply angled (see dotted reconstruction). It would probably have been a short stemmed 'cutty' style of pipe. Cut rim

Type G (fig. 101.41); Moulded seam decoration consisting of leaves with acorns between. The decoration is simply executed and the rim is cut. The spur is chipped but enough of the right hand side survives to show that it was marked with a small circle, moulded in relief. Stylistically this bowl appears to be a little earlier than the rest of the group. This may be residual, unconnected with the kiln waste.

Type H (fig. 101.42); Moulded seam decoration consisting of simply executed leaves without ribs. The rim is cut. As an isolated, smoked example, this piece may well be intrusive to the kiln group.

Type I (fig. 101.43); There is a two-handled cup on either side of the bowl, leaf decoration on the seams and a symbol mark on the spur. The length of surviving stem (85mm) suggests that this was quite a long-stemmed pattern of pipe. All of these examples can be mould matched by flaws, in particular a vertical scratch from the right hand handle of the cup on the left hand side of the bowl.

Type J (fig. 101.44); This pattern is very similar to type I although the bowl is a little shorter. There is a glass on either side of the bowl, leaf decoration on the seams and a symbol mark on the spur. All of these examples can be mould matched. One of the bowls has been slightly squashed in from the end and may have been regarded as a waster because of this. There are two joining fragments which may represent a fifth example of this type but the leaf decoration on the seam is too poorly preserved to be sure of this.

Type K (fig. 101.45); Two pipes from the same mould. Both are likely to be wasters since both have spalled surfaces and the

illustrated example has a copper coloured encrustation on the stem. The rims have been cut and the one surviving stem bore is 5/64". This pipe is likely to have been a short-stemmed cutty type, although long-stemmed versions of this pattern are known.

Type L (fig. 101.46); Three examples, all from the same mould. The bowl has been shaped as a boot and has a cut rim. Along both sides of the stem the words EASY FIT are moulded, incuse, within a relief moulded beaded border. The mouthpiece is of a nipple type but the surviving example has been very poorly moulded. There was not quite enough clay in the mould so the uneven rolling marks are still visible. It also appears that it should have had a lozenge-shaped section near the mouthpiece but that, because of the lack of clay, this has not been properly taken up. The heel of one of the boots appears to have spalled off. The poorly moulded mouthpiece and the missing heel both suggest that these pipes were wasters. Examples of both this type and of a different boot pattern have been recorded from Leicester (Green 1991, 41).

Most of the twelve types described match at least one of the criteria listed above for kiln groups. The types which can most confidently be seen as production waste are B, C, I, J, K and L. These all occur as multiple examples or with clear evidence of being wasters. In contrast, types G and H occurred as single examples which had been smoked. These pieces could be stray bowls which have become mixed with the kiln debris and so should be treated with suspicion. The other four types (A, D, E and F) occurred in small numbers but had generally not been smoked. Stylistically they fit well with the other production waste and are seen as being likely to form part of it.

The 10 forms which are most likely to represent kiln waste were represented by 57 examples of which 12 (21%) showed signs of having been smoked. The presence of smoked pipes has been noted amongst other kiln groups and seems likely to represent pipes smoked by the workers at the manufactory.

Although no complete pipes could be re-assembled it was still possible to reconstruct the form of one of the pipes by overlapping the marked fragments (fig. 101.46). This showed the boot pattern to be a short stemmed or 'cutty' pipe with an advertising slogan, EASY FIT, along the stem. Short stemmed pipes were only introduced in the mid-19th century and, as in this example, usually has a nipple type of mouthpiece. Of the eight mouthpiece fragments recovered this was the only nipple type, all of the others having simple cut ends, a form usually associated with longer stemmed pipes. This suggests that the majority of patterns represented in this kiln group had long stems. This is born out by the bowl types which were often related to stem length too. Table 42 shows the likely length of each form based on an assessment of the bowl type. Eight of the types, represented by 49 (83%) of the fragments, are likely to have been longer stemmed pipes while four of the types, represented by 10 (17%) of the fragments, are likely to have been 'cutty' pipes.

Evidence for workshop practice

Evidence of variation in stem length for the longer stemmed pipes is provided by one of the waste fragments recovered. These pipes would have been made in metal moulds where the stem terminated with a rounded end beyond which was a guide groove for the wire which formed the bore. The maximum length for a pipe was, therefore, determined by this rounded end. In practice it was difficult to achieve a good mouthpiece on a long-stemmed pipe by moulding alone and so the pipemaker usually trimmed the stem with a knife to form a neat mouthpiece. Examination of 17th century kiln waste from Rainford has shown that this led to a variations in the length of pipes, even when they were produced in the same mould (Higgins, 1982, 200). One of the fragments from context 3501 consists of the accidentally fired waste trimmed from the end of a pipe. The rounded mould terminal is visible at the left hand of the illustration while at the other end is the knife cut where the stem was trimmed by the pipemaker (fig 101.47). This surplus length has then been ripped off the moulding wire leaving a ragged slot along one edge of the fragment. The original stem bore is likely to have been $^{4}/_{64}$" and the length of the fragment is 31mm. This provides a minimum variable for the length of this pipe as a result of trimming the mouthpiece.

The stem bores are all either $^{4}/_{64}$" or $^{5}/_{64}$" in diameter; the size range that would be expected for a 19th century group. Each pattern of pipe was associated with a particular size of stem bore (table 41). This suggests that each mould is likely to have had its own specific moulding wire. This is in contrast with the 17th century evidence from the Vergulde Draeck, a Dutch East Indiaman lost off the western coast of Australia in 1656. At this site analysis of the stem bores from a box of unused pipes clearly showed that two wires giving different stem bores had been used to mould the pipes (Green 1977, 162). The Leicester stem bores also show that there does not appear to be any relationship between stem length and bore size, the narrower and wider bores being used for both long and short patterns of pipe.

All of the pipes had simple cut rims, formed by a horizontal knife cut through a slot at the top of the mould. In addition, some of the bowls have internal knife trimming. This is where a sliver of clay has been removed from around the inside lip of the bowl rim to give a narrower or more refined finish. This seems likely to have been reserved for the better qualities of pipe. It was only found on two of the bowl forms, types A and C, but it occurred consistently on all of them. Type A is likely to have been a very long-stemmed 'churchwarden' type. Type C has a much more slender form and stem but appears to be essentially a smaller version of type A. It would be interesting to know whether this type also had a particularly long stem.

Fired pipeclay is very porous and so tends to stick to the smoker's lips as it draws moisture from them. This is the reason why mouthpieces were often sealed with wax, glaze or other substances, many of which do not survive archaeologically. Although no treated mouthpieces were identified, two stem fragments from near the mouthpiece and with traces of a finish were recovered. These both have areas of a thin, pale bluish-grey coating on them. These stems are clearly from a long, thin-stemmed pipe and both have stem bores of $^{4}/_{64}$". Only bowl forms C, D and G match these requirements and type G is a rather chunky pipe which may not form part of the kiln group anyway. It seems most likely, therefore, that this type of coating is associated with form C or D. Type C might be the more likely if it represents a long stemmed pipe of higher quality.

Discussion of the second kiln group

The bowl designs represented in this group are fairly typical of those found in Leicester and Nottingham during the second half of the 19th century (Green 1984; Green 1991; Hammond 1982). There are, however, other common forms, such as acorn, thorn or fluted designs, which might have been expected but which are absent. Most of these designs had a wide currency and versions of them can be found all over the country. One pattern which seems to have been more narrowly confined to the East Midlands is the handled cup design (fig. 101.43) which has already been recorded from Leicester (Green 1991). Variations of this design have also been found at Nottingham (Hammond 1982, fig. 22.141) and are known to have been made at Boston (Wells 1970) and at Market Rasen in Lincolnshire (Hammond 1982, fig. 30.219). These examples

have been variously dated to the period *c.*1870-1890 and provide an indication of the likely date for the Leicester group. This is supported by the Chennery bowl stamp since John and Martha Chennery were pipemakers in Leicester from *c.*1855-86. It seems likely that from *c.*1855 until shortly after 1861 they were working in Canning Street, about a quarter of a mile to the north of the excavated site, and that by 1864 and until about 1886 they were working in Sycamore Lane, about a quarter of a mile to the west of the excavation (Hammond, below p.00).

The single marked pipe consists of a fragmentary bowl which cannot be positively mould matched with the other type B bowls. It is not certain, therefore, whether the whole kiln group can be attributed to the Chennerys' workshop or whether the marked piece should be regarded as a stray fragment which has become mixed with it. The Chennerys' workshops were not far from the site, but even closer was the Salisbury's workshop which lay less than 200yds away at 12 East Bond Street. This operated until 1864 and provides another potential source for the material. Given the evidence for an apparently unsmoked Chennery pipe amongst this group and the fact that the material has clearly been imported to the site from elsewhere the balance of probability must fall, however, in favour of the Chennerys'.

Documentary research has shown that there was wholesale redevelopment of the larger part of the excavated area in about 1865. At this date blocks of land were sold off by the Countess of Devonshire's Charity and Countess Street was laid out (Hammond, below; and Courtney, above). This development would have required large quantities of building materials and provided an ideal opportunity for kiln waste to be used as hardcore, a function which it often served. The documented development provides a plausible event with which to link the archaeological evidence and the date falls firmly within the working life of the Chennerys' workshop. For these reasons it is considered that the kiln waste be seen as a well dated group of material, providing an important fixed point for typological studies and an example of the range of forms being produced by Leicester makers in the mid-1860's.

General discussion

In 1979 Gault was able to list over two hundred known pipemakers from Leicestershire, most of them working in Leicester itself (Gault & Alvey, 1979). Despite this, very few of their products could be identified with any certainty (Higgins 1985), mainly due to the fact that hardly any of them appear to have marked their pipes. The material from this excavation has filled some of the gaps in our knowledge of the Leicester industry, particularly through the kiln groups which have provided a wealth of information about two of the 19th century workshops.

Both groups of kiln waste were found dumped away from their place of manufacture where at least one of them had been used as bedding for a floor. A small group of kiln waste from Flannagan's Frog Island works has been recorded from under the floor of a terrace in Sylvan Street, Leicester while a number of similar bedding deposits have been recorded from Nottingham (Hammond 1982, 27-33). The 1864 specification for laying out Countess Street includes the use of 'hard rubbish' for foundations and it seems clear that pipe kiln waste was widely used as hardcore in urban areas. Such deposits form a valuable source of information, particularly if the buildings under which they are sealed can be accurately dated.

The waste from King's workshop of *c.*1820 has shown that a range of marked and decorated heel and spur pipes were in production. The marks consisted of his initials or symbols moulded onto the heels of the pipes. No bowl marks were recovered from this group although it is known that he employed moulded lettering around the rim of some of his designs. The decoration consists of a variety of fluted or scalloped designs, sometimes used in conjunction with leaf moulded seams and other foliage motifs. This range of marking and decoration is very similar to that found in Nottingham during the early 19th century (Hammond 1982). There are a few examples of similar designs in Derby Museum, but insufficient work has been carried out to draw any firm conclusions about the industry there at this period. At Lincoln similar designs are also found although there they tend to be accompanied by a wider range of other decorative motifs (Mann 1977). To the south and west in Northamptonshire and Coventry these designs do not appear to form a significant part of the local assemblages (Moore 1980; Muldoon 1979).

It appears that Leicester lay towards the south-western edge of an area over which fluted and scalloped designs were common. The evidence from the decorative stem borders and moulded bowl lettering supports this view and suggests that a 'stylistic region' developed during the later 18th and early 19th centuries over which common styles developed and spread. Despite the common links over this area there are not as many specific points of similarity between the pipes produced at each centre as there are differences between them. For example, slave and indian motifs occur in Lincolnshire but not at Nottingham while royal coats of arms occur at Nottingham but not in Leicester. Conversely, different makers in Leicester appear to have been making virtually identical, and specific, patterns of fluted pipe which are not found in Nottingham. These differences may be due to the influence of the elusive mould makers who, although working within a common tradition, may have influenced local markets by the range of designs with which they were familiar and which they could produce.

Whatever the mechanisms for style and change it is clear that by the 1860's the patterns represented in the second kiln group were distinctly different from the first. Although plain and decorated forms were still being produced they were by then all of spur rather than heel types. The best quality pipes were probably still plain, being represented by a neatly finished 'churchwarden' type (fig. 100.33). Fluted decoration had disappeared to be replaced by other decorative elements such as the boot, cup and glass motifs. The biggest change had come with the introduction of short stemmed 'cutty' pipes, which represented about 17% of the later group.

Summary

The pipes from this excavation have established that Leicester lay on the south-western limits of a 'stylistic region' extending east and north into Lincolnshire, Nottinghamshire and, probably, Derbyshire during the later 18th and early 19th centuries. It was also a production centre for pipes with moulded lettering around the rim of the bowl. The most significant groups recovered consisted of two dumps of kiln waste which had apparently been used as hardcore for building work.

The first group dates from *c.*1820 and contains 16 different patterns of pipe which can be attributed to Richard King. He was producing a range of plain and decorated long-stemmed pipes with red wax being used to coat the tips. The pipes had curved stems and the best quality ones appear to have had plain bowls. Other makers appear to have been making the same range of designs as King which suggests a competitive industry producing a fairly limited range of designs.

The second kiln group can be dated to *c.*1865 and illustrates ten or twelve forms of pipe which were being produced in Leicester, probably in the Chennerys' workshop. About half of the pipes were plain and over 80% of them were long-stemmed varieties, which is interesting for a period when cutty pipes were rapidly gaining a foothold in the market. It has been shown that stem length could vary by at least 31mm as a result

of finishing methods and that specific workshop practices, such as internal bowl trimming, stem bore and mouthpiece coatings, can be associated with particular patterns of pipe.

Acknowledgements

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Illustrations

fig. 98 ***The domestic pipes***

1. Spur bowl, fully milled, quite a good overall form to the bowl but with rough nodules or lumps on the surface of both sides, *c.*1660-80, stem bore $^{8}/_{64}$". A1.1991 2147.

2. Spur bowl, half milled, internally trimmed rim, *c.*1660-80, stem bore $^{8}/_{64}$". A1.1991 2062.

3. Spur bowl, three-quarters milled, internally trimmed rim, stem bore $^{7}/_{64}$", *c.*1660-80. A1.1991 2301.

4. Spur bowl, three-quarters milled, stem bore $^{7}/_{64}$", *c.*1660-80. A1.1991 2301.

5. Spur bowl, half-milled rim, stem bore $^{6}/_{64}$", *c.*1670-90. A1.1991 363.

6. Spur bowl, half-milled rim, stem bore $^{7}/_{64}$", *c.*1670-90. A1.1991 2358.

7. Spur bowl, half-milled and internally trimmed rim, stem bore $^{7}/_{64}$", *c.*1680-1710. A1.1991 374.

8. Spur bowl, not milled, internally trimmed rim, stem bore $^{6}/_{64}$", *c.*16801710. A1.1991 374.

9. Broseley style heel bowl with traces of an incuse maker's mark, which probably read IW. Not burnished, stem bore $^{7}/_{64}$", *c.*1680-1730. A1.1991 971.

10. Heel bowl, with a cut rim and an internal bowl cross, stem bore $^{4}/_{64}$", *c.*1730-70. A1.1991 2755.

11. Stem fragment with part of an incuse Midlands style stem border, *c.*1760-90, stem bore $^{5}/_{64}$". A1.1991 2358.

12. Stem fragment with an incuse Midlands style stem border and a stamp reading IOHN WARD DARBY, *c.*1760-90. Stem bore $^{5}/_{64}$". A1.1991 3505.

13. Stem fragment with part of an incuse Midlands style stem border and a stamp reading IOHN WARD DARBY, *c.*1760-90. Stem bore $^{5}/_{64}$". A1.1991 2358.

14. Spur bowl with relief moulded decoration and maker's mark. The bowl has a cut rim, below which is moulded ??FLUDE / LEICESTER. There are almost completely illegible initials moulded on the spur, the second of which may be a B or an R. Stem bore $^{4}/_{64}$". Probably made by John Flude, of Leicester who was apprenticed in 1738 and working until at least 1768. A1.1991 3505

15. Fragment of a spur bowl with simple leaf decoration on the seams, stem bore $^{4}/_{64}$", *c.*1800-1840. A1.1991 1293.

fig. 99 (16-24) and **100** (25-32) Kiln Group I (A1.1991 2358); attributed to the workshop of Richard King of Belgrave Gate and with likely deposition date of *c.*1820.

16. Plain spur bowl, with an internal bowl cross. Composite drawing from three fragments.

17. Plain spur bowl, with a double internal bowl cross.

18. Plain spur bowl, with an internal bowl cross.

19. Plain spur bowl, with an internal bowl cross.

20. Plain spur bowl, without an internal bowl cross.

21. Plain heel bowl, with relief moulded initials RK. Composite drawing from more than one fragment.

22. Plain heel bowl, with relief moulded initials RK.

23. Plain heel bowl, with relief moulded initials RK.

24. Decorated heel bowl, with relief moulded initials RK.

25. Decorated heel bowl, with relief moulded star mark.

26. Heel bowl fragment, with relief moulded star mark.

27. Decorated spur bowl. Drawing of a bowl in the author's possession but from the same mould as two fragments from this context, the outlines of which are indicated with dashed lines.

28. Decorated spur bowl.

29. Decorated spur bowl.

30. Decorated spur bowl, with the moulded lettering SHERR.. / ..AIN for Edward Sherry of Gainsborough, recorded working 1792-1820; died 1822.

31. Decorated bowl fragment.

32. Decorated bowl fragment.

fig. 100 (33-35) and **101** (36-47) Kiln Group II (A1.1991 3501); attributed to the workshop of John and Martha Chennery of Sycamore Lane and with likely deposition date of *c.*1865. A full description of these bowls can be found in the text.

33. Plain spur bowl, from a 'churchwarden' type of pipe.

34. Plain spur bowl.

35. Plain bowl fragment, similar design to 34 but with an incuse bowl stamp reading CHENNERY / LESTER. Made by John and Martha Chennery of Sycamore Lane.

36. Plain spur bowl.

37. Plain spur bowl, similar to 36 but with a small dot on the right hand side of the spur.

38. Plain spur bowl.

39. Plain spurless bowl.

40. Plain spurless bowl, the likely angle of the stem based on the stem bore is indicated by a dotted line.

41. Decorated spur bowl, with a moulded symbol mark consisting of a circle on the spur.

42. Decorated spur bowl.

43. Decorated spur bowl, with a moulded symbol mark on the spur.

44. Decorated spur bowl, with a moulded symbol mark on the spur.

45. Spurless bowl, with ribbed seams. There is a metallic encrustation on the stem and the bowl has spalled, suggesting that it is a waster.

46. Promotional pipe with the bowl moulded in the form of a boot and the incuse, sans-serif lettering 'EASY FIT' moulded on both sides of the stem with in a relief moulded beaded border. The complete form has been reconstructed from two overlapping fragments. The mouthpiece fragment has been

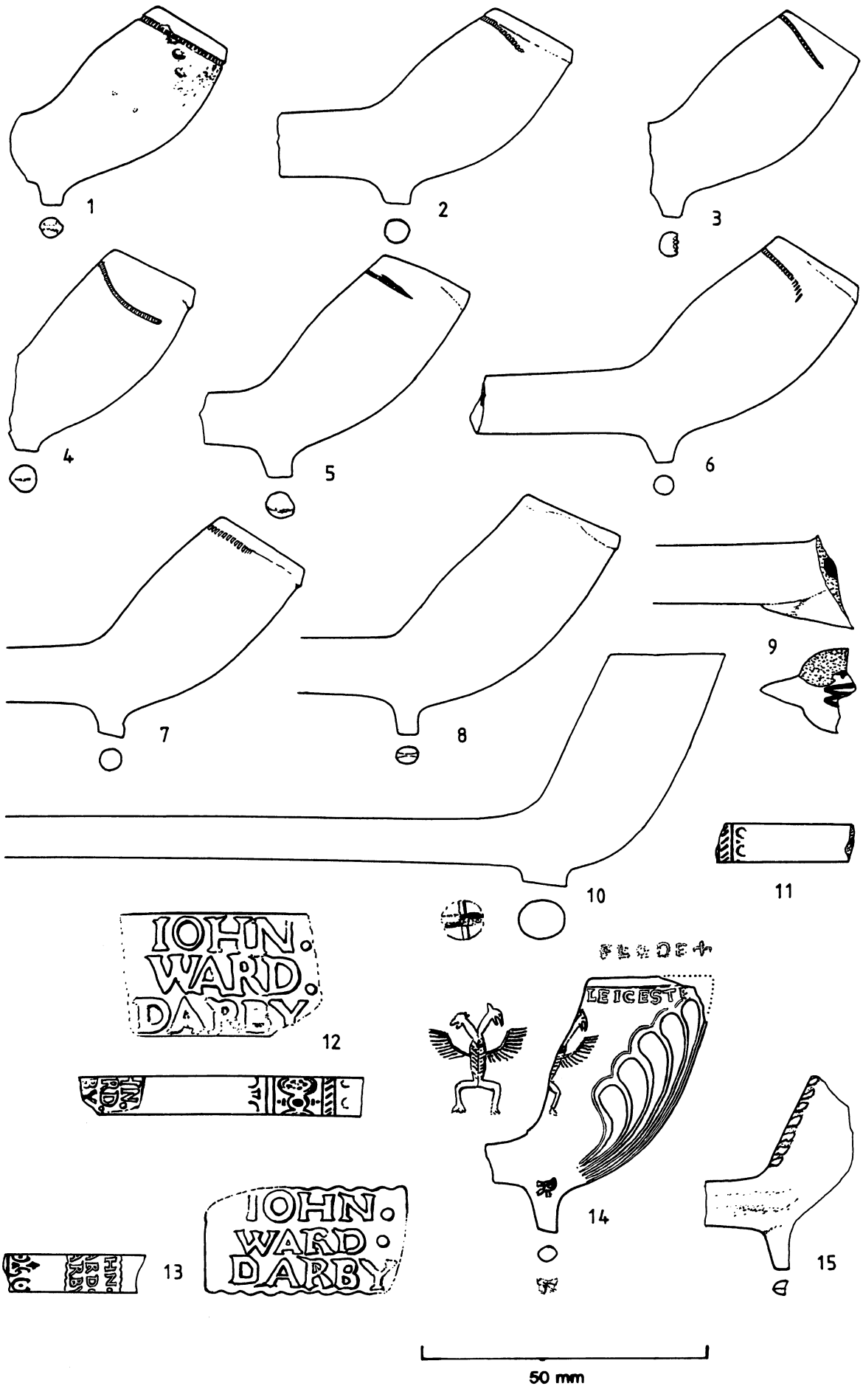

Fig. 98: *Miscellaneous domestic pipes. Scale 1:1 with stamp details at 2:1.*

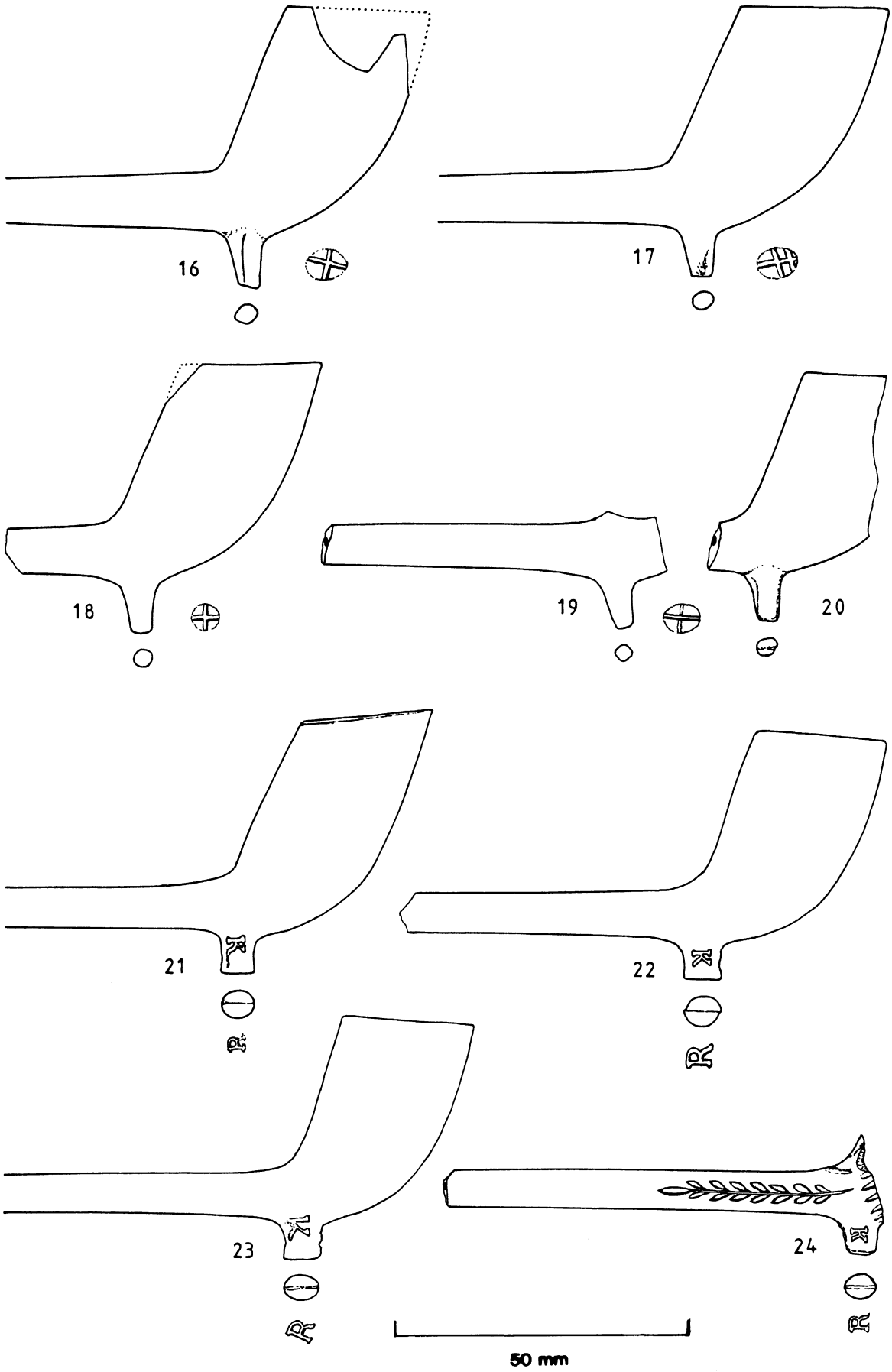

Fig. 99: ***Kiln Group 1, c.1820, attributed to Richard King. Scale 1:1.***

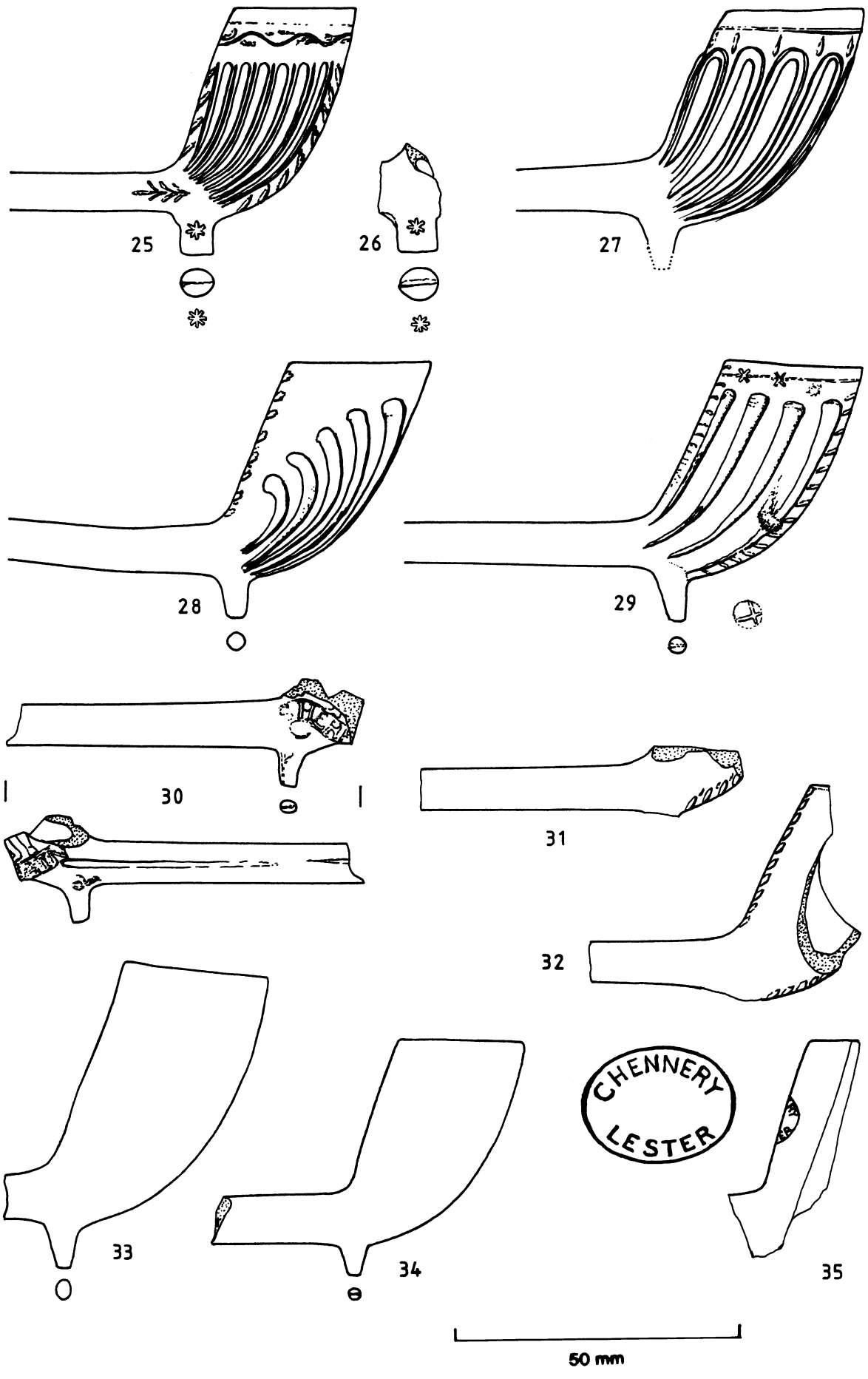

Fig. 100: *25-32 Kiln Group 1, c.1820, attributed to Richard King; 33-35 Kiln Group 2, c.1865, attributed to John and Martha Chennery. Scale 1:1 with stamp detail at 2:1.*

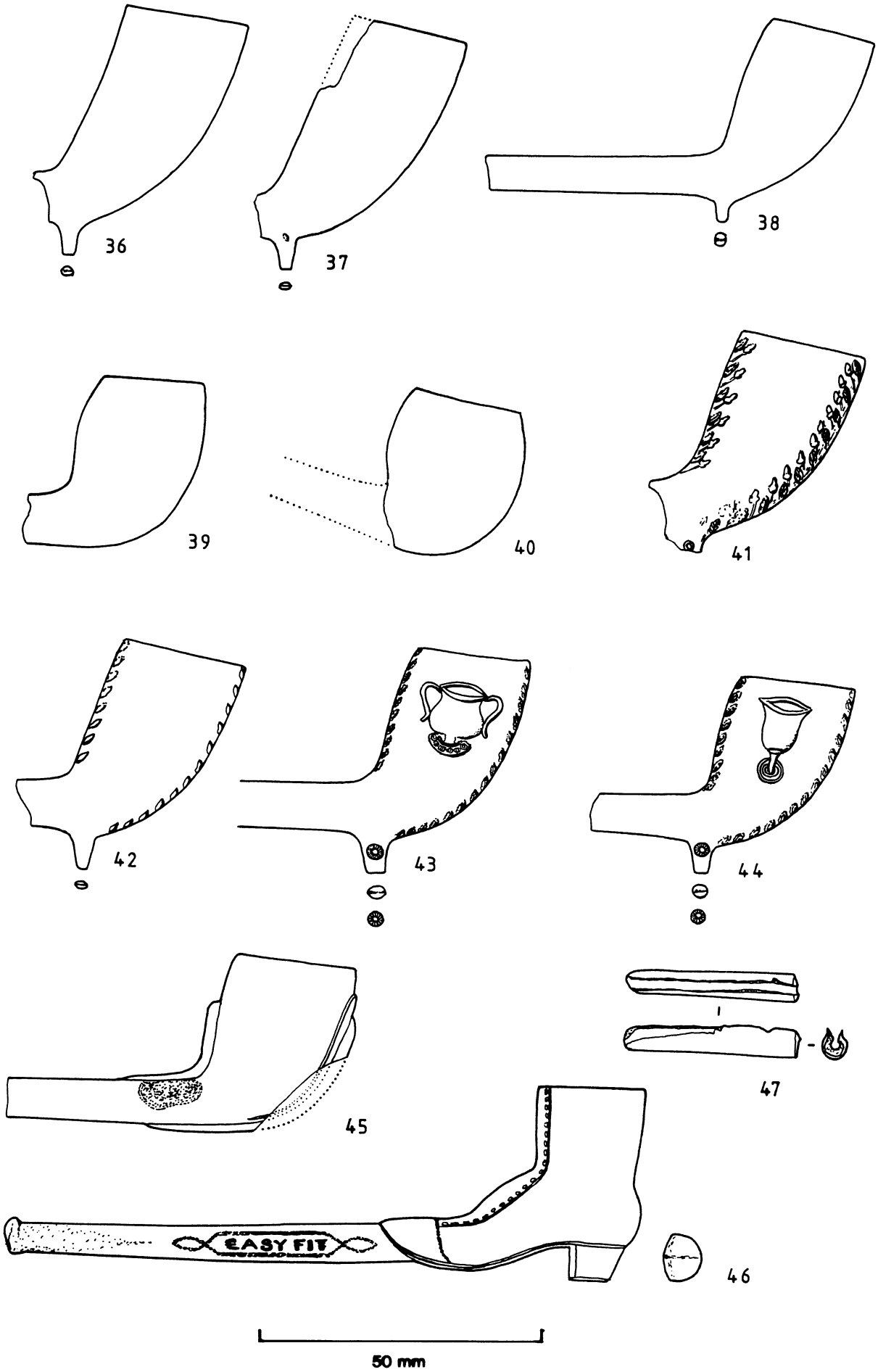

Fig. 101: ***Kiln Group 2, c.1865, attributed to John and Martha Chennery. Scale 1:1.***

incompletely moulded but would have been of a nipple form with a diamond shape terminal to the stem. Stem bore 4/64".

47. A waste trimming, 31mm long, from the mouthpiece end of a long-stemmed pipe which has been accidentally fired in the kiln. One end is rounded where it has taken up the 'mouthpiece' end of the stem from the mould, the other is knife cut where it has been trimmed off. The whole piece has then been ripped off the moulding wire leaving an irregular slot along one site. The original stem bore is now rather distorted but is likely to have been 4/64".

Pipemakers in the vicinity of East Bond Street

P.J. Hammond

This is a summary of the documentary evidence collected about buildings and pipemakers in the vicinity of East Bond Street. A complete version is available in the site archive.

Detailed examination of the inhabitants and occupations of the East Bond Street/Causeway Lane area of Leicester has revealed only one clay pipe manufactory in this vicinity during the 19th century.

The manufactory in question was located at what became 12 East Bond Street and was owned and run by the Salisbury family, viz George and his son Thomas. George Salisbury was born and married in Derby and appears to have moved to Leicester *c.*1790. George appears to have retired by *c.*1840 when he was in his mid 70's in favour of his son Thomas. The latter advertised in Trade Directories as a 'Pipe Manufacturer and China, glass and Staffordshire dealer' (Green 1984, 9) and took sole responsibility for the business following his father's death in 1847. Thomas died in 1855, aged 59, after which both his wife Matilda and his daughter Emma continued to run the workshop until *c.*1864 – after which they are no longer listed.

Other clay pipe making workshops appear to have been some distance away from East Bond Street. One of these was in Sycamore Lane where John Chennery was working by March 1864 (Leicestershire Record Office; 7D67/576). The 1861 census records that he was at Canning Street. Both Canning Street and Sycamore Lane are some distance from East Bond Street and, unless Chennery worked elsewhere in the meantime, it would appear that his kiln waste, possibly like that of Richard King (below), was being transported some distance for use as hardcore.

Richard King (1775-1828); grocer, tallow chandler and tobacco pipe maker

Richard King was baptised in 1775, the son of William King, framework knitter, and his wife Mary. At the age of 14, Richard was described as a poor child of the parish of St. Mary when he was apprenticed to Thomas Veasey, a framesmith. Sometime after 1796 Richard must have decided that being a framesmith was not for him – possibly he changed his occupation during the period when he met his wife to be Mary Hichman. On 3 December 1803 they were married at Leicester St. Margaret.

The earliest entry indicating that Richard was a pipe maker occurs on 31 May 1805 when he advertised in the *Leicester Journal* for an apprentice.

A further advertisement appeared less than two years later on 26 July 1807:-

> Wanted – A stout lad, about 13 or 14 years of age, as an apprentice to a pipe maker. Enquire of R. KING, chandler and pipe maker, West Bridge, Leicester.

These advertisements not only confirm that Richard was actively involved in manufacturing pipes by this time, but also that he worked at West Bridge prior to his move to Belgrave Gate. West Bridge was situated on the River Soar at the west of Leicester, quite some distance from both Bond Street and Belgrave Gate.

Although King is recorded at West Bridge in 1807 the first directory to refer to him was in 1811 when he was listed as being a grocer of Belgrave Gate. Subsequent directories, such as *Fowler's Directory* of 1815, describe him as a grocer, tallow chandler and pipe maker of the same address. A detailed search of the Rate Books and comparison with directories and the 1841 census has demonstrated that King's house was situated at the western end of Belgrave Gate close to the Haymarket and was next door to the 'Star' public house on the east side of Belgrave Gate. It would appear that King actually occupied the property which subsequently became either 11 Haymarket or 1 Belgrave Gate.

Confirmation of the move was made in the *Leicester Journal* by an advertisement dated 25 March 1808, as follows:-

> RICHARD KING
> Grocer, chandler, and tobacco pipe maker
>
> Returns grateful acknowledgements to his numerous friends and the public, for the liberal patronage expended in his late situation, and respectfully informs them, he is removed to more desirable premises at the tope of Belgrave Gate, where he hopes to meet a continuance of the favour and support.
> N.B. A stout active lad of good morals and disposition wanted as an apprentice. Leicester Mar 24 1808.

Following his move from West Bridge, Richard King remained at Belgrave Gate, where he was listed in the trade directories. King clearly established a flourishing business since the apprenticeship registers show that he took on at least eight apprentices between 1804 and 1820: George Hall 1804; Thomas Banford 1805; Henry Kirkby 1808; Robert Bennett 1810 (free 1820); John Gamble 1814; Robert Wilson 1817 (free 1826); Joseph King, his son, 1818 (free 1826) and Benjamin Bull Dexter 1820. This means that, in addition to his full time staff, King usually had three or four apprentices at any one time. In the apprenticeship registers King is variously described as a grocer, tallow chandler and pipe maker and it seems likely that most of these apprentices would have worked for at least some of the time in the pipe shop. Two of them, Bennett and Wilson, later became master pipe makers in their own right (Green 1984; Gault & Alvey 1979). King died on 16 February 1828 and was buried four days later at Harvey Lane Baptist Chapel burial ground, being described in the register as 'Richard, husband of Mary King, aged 53 years, of St. Margaret's parish'.

Neither Richard King nor his widow left a will, but it would appear that none of his children continued with the pipe making side of the business.

Tobacco pipe kiln material.

A.A. Peacey

Three groups of tobacco pipe kiln material have been recovered from this site, a single fragment of stem slag laminate which was excavated in 1980 (8052, F911) and two 19th century assemblages excavated in 1991. The first of these (2358) was sealed in about 1820 beneath a brick cellar floor and has been attributed to the workshop of Richard King (Higgins, above) The second (3501), consists of material from a general cleaning layer. This dates from about 1865 and may derive from the kiln of John and Martha Chennery (Higgins, above). This report deals primarily with the first group which by virtue of both stratigraphy and size assumes most importance.

Material from the kiln structure and furnishings is divided according to composition of fabric. In the catalogue thirteen

divisions are listed, ten of these are distinctly different fabrics whilst three cannot be fully assessed due to vitrification, discoloration and slagging. Fabric type numbers, allocated on a first encountered basis, are as follows:

Fabric

1. Red brick earth with well rounded mineral inclusions up to 3mm.
3. White fabric with visible quartz, other mineral inclusions and organic voiding. Opaque quartz chips up to 8mm and occasional stem trimmings.
4. White fabric with visible quartz, other mineral inclusions and organic voiding. The mineral inclusions are fine rounded grains up to 1mm with similarly fine organic voiding.
5. White fabric consisting of compacted pipe trimmings.
6. Finest white fabric, used predominantly for the manufacture of the pipes themselves. Inclusion free to the naked eye.
7. Pinky buff fabric with quartz and other mineral inclusions upto 3mm with occasional pipe trimmings.
8. White fabric with visible quartz, other mineral inclusions and organic voiding. The inclusions, upto 3mm in size, include iron bearing material which bleeds into the surrounding matrix.
9. White clay with added organic matter indicated by voiding. Of relatively low density.
10. Light coloured clay, content obscured by vitrification.
11. Fine red fabric. Inclusion free to the naked eye.
12. Light coloured firebrick fabric with self coloured grog.
13. White clay, vitrified, content obscured by vitrification.
14. White clay with organic inclusions, exact composition obscured by vitrification.

The mineral inclusions may occur in the parent clay. The crushed pipe and organic material are clearly additions.

Pipe kilns are known in two basic forms: muffle kilns and open flame kilns. The former has a sealed inner chamber or muffle to contain the ware whilst in the latter saggars fulfil this function. A muffle kiln depends upon internal load bearing features and furniture to support and separate, whilst in an open flame kiln the saggars satisfy these requirements also. Both kiln groups from this site are from muffle kilns, and the first group includes muffle material, furniture, furniture supplements together with sub-structure and shell fragments.

The muffle material is distinguished by a number of well established criteria common to the majority of muffle assemblages previously examined. These are:-

1. Fabric liberally reinforced with prefired pipe stems.
2. External [convex] surface slagged/glazed/or discoloured by direct contact with fire.
3. Internal [concave] surface covered with layer or layers of clean white clay lute.
4. Step or cornice type peripheral shelving projecting inwards from the internal surface.
5. Prop or bar type buttresses projecting outwards from the external surface.

All of these criteria are present in the first kiln group (2358). Sixty eight muffle fragments are formed from Fabric 3, one muffle fragment is formed from Fabric 4 and a further 16 muffle fragments, being vitrified, have not been allocated to a fabric group.

The muffle represented by this assemblage was of the developed type known from early nineteenth century encyclopaedias (Good *et al* 1813 ; Rees 1819, 3, 31). The type example from the archaeological record comes from Waverly Street, Bristol (Peacey 1982, 10-13; fig.102 inset). The Causeway Lane muffle was of cylindrical form with external bar type buttresses and internal peripheral shelves of cornice type (fig. 102b). The flue space around the muffle varied between 30 and 60mm. Thirteen fragments from the muffle rim were recovered. The stem reinforcing in the muffle walls is predominantly horizontal with diagonal stems at the buttress interface with the muffle wall. An assemblage of this size cannot be considered fully representative. The absence of step type shelf or side opening fragments must not be overstated since these features almost certainly existed in the complete muffle. One idiosyncrasy in the method of construction is worthy of note. The buttressing, of bar type without any pipe stem reinforcement, is formed from rolls placed one upon another as the building progressed (fig.102a). This suggests either a muffle constructed inside an existing shell or coincidental building of muffle and shell. As other muffle builders dealt with the problem in other ways, the use of rolls seems more likely to stem from a personal idiosyncrasy rather than to have been dictated by conditions imposed by the structure. This idiosyncrasy appears to manifest itself again in a series of unparalleled furniture supplements from this site.

Material which occupied a position outside the muffle is generally contaminated by the fire either by slag build up, flash glazing or discoloration. Material which occupied a position inside the muffle is by contrast clean, slag free, often displaying evidence of lute wash. Such objects or fragments derive from furniture and furniture supplements. The former are prefabricated reusable objects whilst the latter, formed from unfired clay whilst the packing was in progress, were discarded after each firing.

This assemblage includes 4 fragments of furniture from 3 separate objects. One Type P4a (Peacey 1996, 43) hollow waisted cylinder 65mm high and two Type 2a props, hollow cylinders 59mm and 75mm high (fig. 103). Fabric 7 is used solely for this object whilst Fabric 8 is also used for repairs and alterations to the muffle. Amongst these are muffle lining (distinguished by its luted inner surface and unstained contact outer surface), lute wash, and a fragment representing alteration of a shelf height.

Furniture supplements are represented by 203 fragments in 3 Fabrics. These are:-

Rolls – Idiosyncratic irregular serpentine rolls apparently formed by combinations of rolling twisting and squeezing a very wet fabric in a cloth covering (figs. 104a-g).

Roll Type 5 – Short roll with ends spread or flattened to form a strut (figs. 105h-j).

Strap Type 1 – Straight or near straight strap formed from a roll by flattening into a strip or strap (fig. 105k).

Wad Type 1 – Straight or near straight wad with near parallel contact surfaces; formed from a roll by pressing between other objects (fig. 106n).

Wad Type 4 – Shaped as if pressed into a joint between bricks and smoothed over the vertical surface to form a T section (fig. 106p).

Wad Type 5 – Circular wad or fragment from such; with near parallel contact surfaces; formed from a roll looped into a ring (fig. 106o & q-s).

Applied strip Type 1 – Of D section formed from a roll by pressing against another surface; having a single contact surface (fig. 105l).

Applied strip Type 2 – Of triangular section; having a single contact surface (fig. 107u).

Thin sheet Type 1 – A flat thin sheet up to 3mm thick having near parallel surfaces (figs. 107t & v).

The study of furniture supplements is in its infancy. These classifications are based on cross-section and contact deformation, neither of which are necessarily consistent throughout. There is no reason why fragments displaying the characteristics of rolls, wads, applied strips and straps, should not all come from one object. An example of this is shown (fig. 106m) which illustrates a roll with one end deformed into a wad. Although there are examples of furniture supplements found complete (Type 5 wad and Type 5 roll for example), the greater body of evidence, encountered as fragments, reflects less formalised objects.

With the exception of roll Type 5 the supplements from Causeway Lane are all closely parallelled from many other sites (Peacey 1996, Chapter 6). It is usual for them to be made either from clean white clay or white clay with voiding from organic additions. Whilst 31 of the fragments in the Causeway Lane assemblage fall into this pattern, the remaining 272 fragments are in Fabric 4. It may be that this fabric represents the residue of some part of the refining process used to obtain inclusion free clay for pipe making. Sieving or settling would both produce concentrations of such material, either in the sieve or as stratified deposits left in the bottom of settlement tanks after fine clay in suspension had been drawn off. The absence of similar material from other sites may indicate use of a different clay source, alternatively different methods of preparation. The former appears the more likely. Evidence from a number of documentary sources confirms that very little that could be used, was wasted. Material too coarse for the manufacture of tobacco pipes could be used to fabricate the muffle, for structural work or even clamming for the wicket and cracks in the ever moving brickwork of the kiln shell. From Tweedmouth there is a record of material swept from the cobbles being used for this last purpose (Roberts 1988, 94).

The purpose of the roll formed struts (Type 5) is unclear. They clearly occupied positions in the angle formed between objects. The angles vary between 65° and 90°. Although furniture supplements are recorded from another 90 sites, they include no similar objects. The rolls from the Causeway Lane assemblage also differ from the consensus form. They are generally of larger diameter, less well formed by a combination of rolling and squeezing, with a surface texture indicative of sticky wet handling characteristics. Longitudinal undulations in the roll surface suggest formation in cloth. Vestigial patches of texture suggest either palm prints or contact with a twill woven cloth. Although the group is substantial, 146 fragments, there are few stem and no bowl impressions. Of the stem impressions that are apparent 24 are concentric mouthpiece end impressions (fig. 104d & e) whilst only 4 reflect the more usual transverse stem contacts. The only indicators of function are occasional pinches (fig. 104c) or finger wipes (fig. 104f) which may indicate location to some other object, but no firm conclusion can be drawn from them. Approximately one third of the fragments have one existing unbroken end. These ends are carelessly formed, of no particular shape. Six examples have been overlapped and crudely squeezed together. The crude form and surface texture of these rolls probably result from the course nature of the fabric which would demand a greater quantity of moisture for it to remain plastic. The predominance of stem end impressions suggest a position above the charge possibly providing support for some other covering material. As none of the rolls display any significant fire damage it is unlikely that they represent the entire crowning structure.

Evidence from other sites (Peacey forthcoming, Chapter 7), together with contemporary descriptions (Good 1813; Rees 1819, 3, 31), show that in general practice the muffle was supported on pillars above the firebox. This part of the kiln was subject to heavy slagging. The massive structural fragments listed in the catalogue, all heavily slagged, probably come from this part of the structure. Debris falling down the flues around the muffle each time the cover and wicket were broken open would end up in the fire box. Some loosely bound heavily slagged material recovered is consistent with such debris rather than structure.

The assemblage includes a number of brick fragments which might derive from the outer shell or base of the kiln. These include fragments of commercial fire brick. Both Good and Rees record the use of fire brick for kiln linings in the first two decades of the 19th century (*ibid*).

Small, often overlooked, fragments of fired white clay were retained. Some of these illustrate details of the manufacturing process. Three items in particular have been identified:

'Dottle'- clay built up on the leading end of the piercing wire as it passes through the stem blank to form the bore; sometimes seen still attached inside the pipe bowl on pipes of lesser quality pellets of clay, up to 3mm across, built up in layers, having one concave surface and one convex surface.

'Stem Trimmings' – Extruded fragments of shallow triangular section, up to 4mm across, having a smooth basal surface and rippled upper surfaces formed against the surface of a tool as it was drawn along the stem to remove the seam. Similar fragments have been reproduced in the workshop.

Stem end trimmings – Short blunt rounded stem ends cut with a twisting movement of knife round a wire in place in the stem bore. Helical forms which if flattened would form a thin slice through a pipe stem. These latter probably reflect a second finer cut.

As this type of material represents the interface between pipe and mould its collection and study could cast additional light upon the form and development of these crucial objects. Archaeological data is already massing concerning mould design at the bowl mouth (Peacey 1996, Chapter 6). To date this supports the use of a knife slot design. Unfired clay trimmings, or 'spew' as it was sometimes known (Walker 1977 137), seems to have been used in a number of cases to form crude bricks or other objects for use in the kiln. Fabric 5 from this assemblage falls into this category. Of the 11 fragments recovered only one displays any significant form. One surface is formed as if in a round bottomed dish, all others being breaks. As the material has been fired it clearly passed through the kiln. It may be that it represents spalls and other debris collected in the base of the muffle bound together by lute spillage from the washes applied to the interior of the muffle between firings. Its nature is extremely friable.

The second kiln group (3501), contains one fragment from a category of material not included above. This fragment consists of a layer of pipe stems, laid parallel, sandwiched between a thin clay sheet and a layer of slag (fig. 107w). The clay sheet is formed from white clay with voiding from included organic matter. Similar material hase been recorded from 27 other sites in the British Isles. Clearly this material represents a common process. The slagged surface opposed to a surface free from fire damage indicates a position between the muffle contents and the flue. This position is largely filled by the muffle itself. Slag laminates are, therefore, likely to come from the temporary closures of the openings in the side and top or the muffle. Combined documentary and archaeological evidence suggests that it was common practice to cover the loaded muffle with sheets of clayed paper followed by a framework of prefired pipe stems rendered over with fusible material (Peacey forthcoming Chapter 6).

A Catalogue of the finds is kept in the site archive.

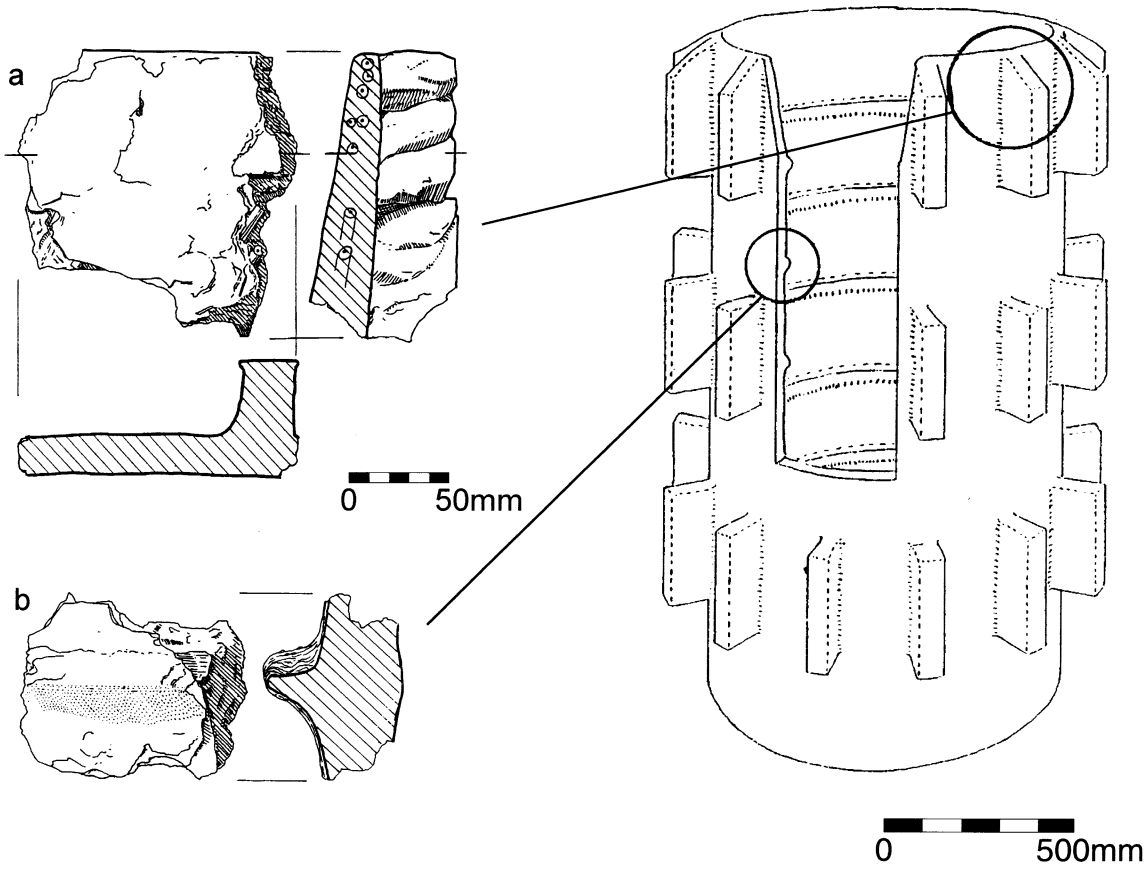

Fig. 102: ***Muffle fragments from Kiln Group 1, c. 1820 attributed to the workshop of Richard King***

Fig. 102 *Kiln Group 1, c.1820: Muffle fragments*

a) Rim fragment from the muffle wall with external buttress formed from short rolls. The elevation shows the inner surface. To the right is a vertical section through the stem reinforced wall with side elevation of a buttress. Below is a horizontal section. Scale 1:2

b) Muffle wall fragment with cornice type peripheral shelf. The elevation shows the inner surface. To the right is a vertical section showing lute accumulation on the inner surface and shelf. Scale 1:2

Inset A developed muffle typical of the period based on a contemporary section illustrated by Rees (1819) modified in compliance with archaeological evidence. Scale 1:20

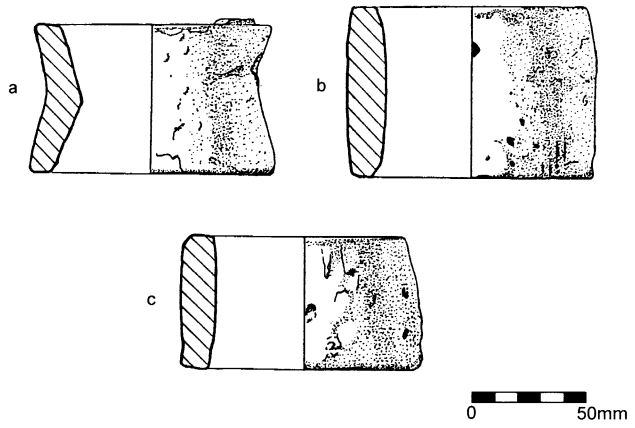

Fig. 103: ***(a) Type 4a b) Type 2a c) Type 2a***

Fig. 103 *Kiln Group 1, c.1820: Props*

a) Type 4a prop liberally coated with white clay lute. Formed from Fabric 8.

b) Type 2a prop with traces of white clay lute. Formed from Fabric 7.

c) Type 2a prop with traces of white clay lute. Formed from fabric 7.

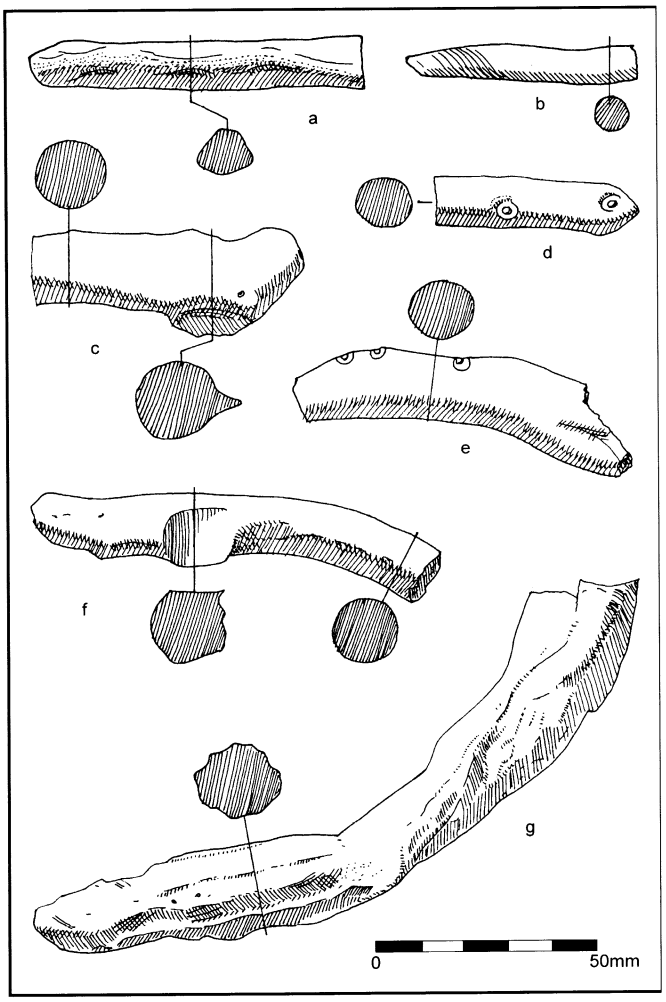

Fig. 104: ***Roll fragments***

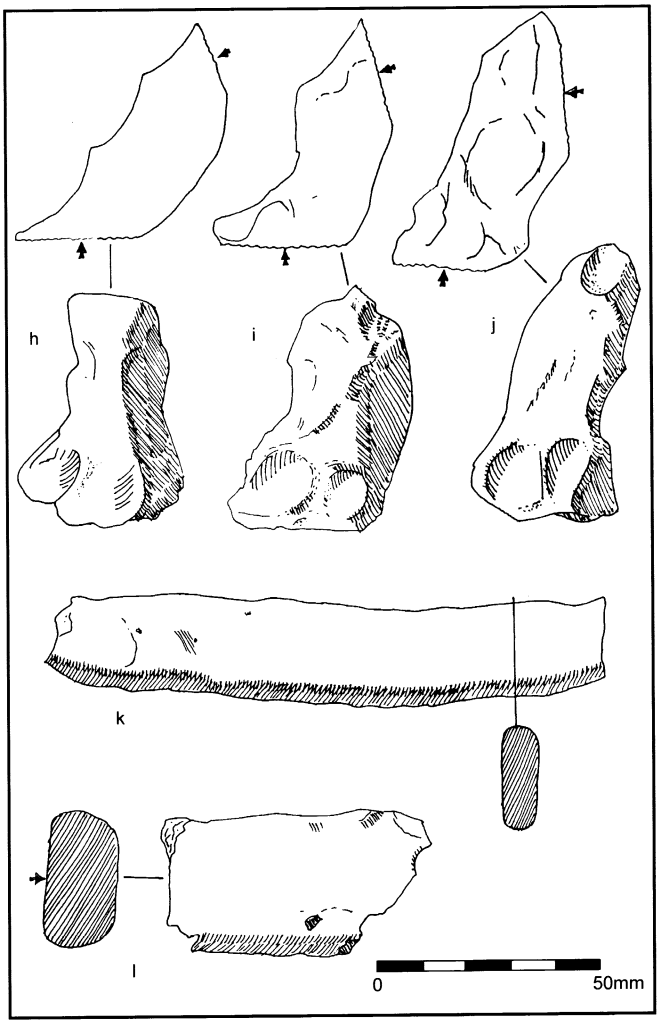

Fig. 105: ***Roll, strap and strip fragments***

Fig. 104 *Kiln Group 1, c.1820: Furniture supplements.*

a) Straight roll fragment with one unbroken end.

b) Straight roll fragment with one unbroken end.

c) Roll fragment with one unbroken end and pinch.

d) Straight roll fragment with one unbroken end and two stem end impressions.

e) Curved roll fragment with three stem end impressions.

f) Curved roll fragment with one unbroken end and finger wipe.

g) Curved roll fragment with one unbroken end. The regular ridges and furrows suggest formation in cloth.

Fig. 105 *Kiln Group 1, c.1820: Furniture supplements*

h-j) Type 5 rolls. The angled contact surfaces arrowed, and the finger press marks indicate use as struts.

k) Type 1 strap fragment formed by flattening a roll. The absence of contact impressions indicates that this was done prior to use distinguishing it from an applied strip.

l) Type 1 applied strip fragment with contact surface arrowed.

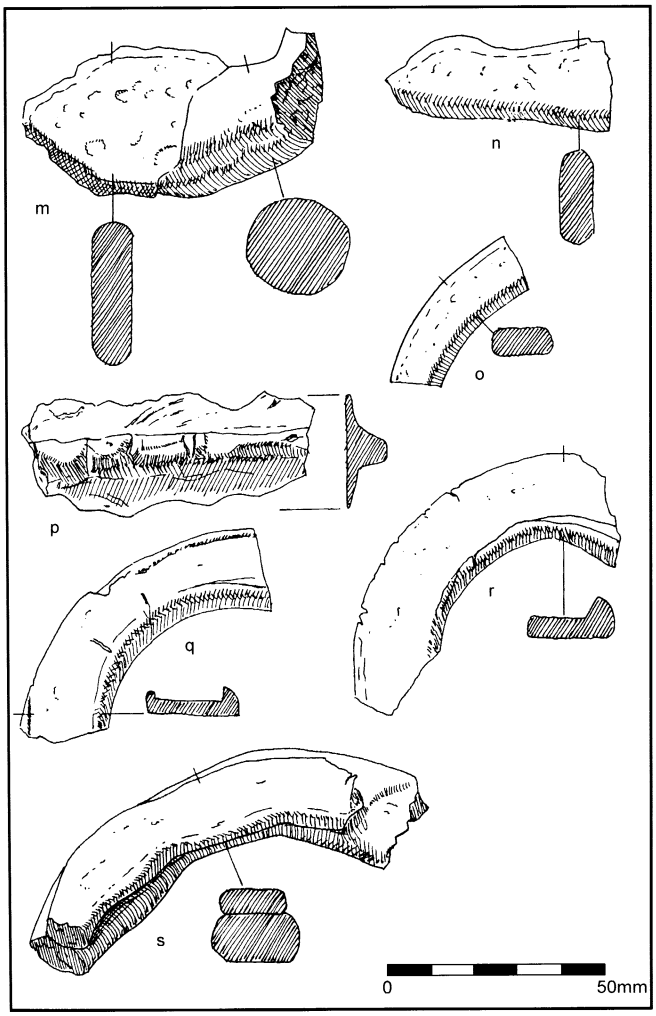

Fig. 106: ***Roll and wad fragments***

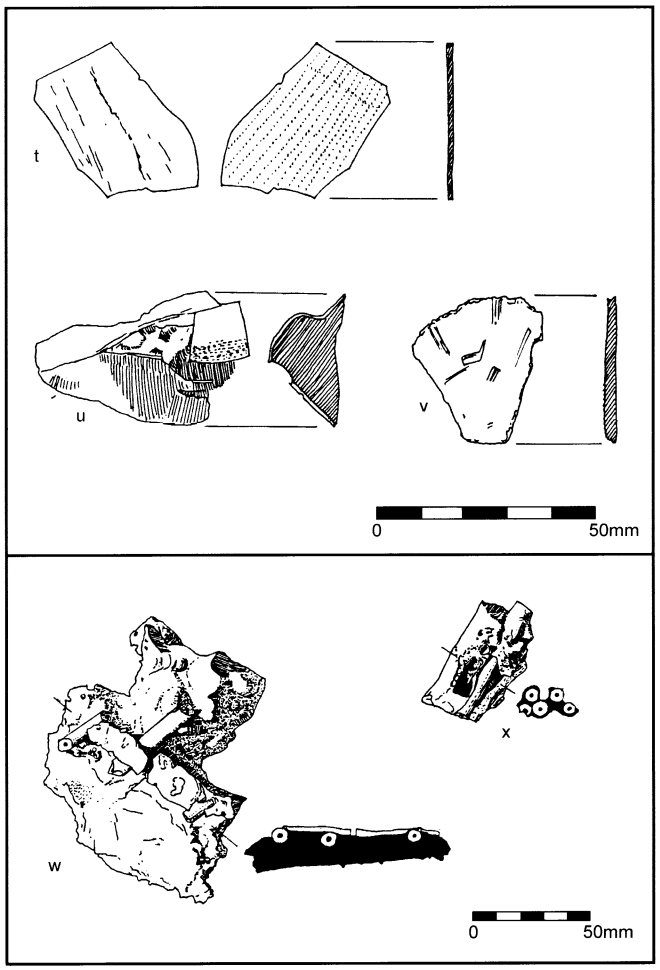

Fig. 107: ***Sheet fragments, strip fragments, stem slag laminates***

Fig. 106 *Kiln Group 1, c.1820: Furniture supplements*

m) Roll fragment with one unbroken end deformed by pressure between parallel surfaces to form a wad.

n) Type 1 wad fragment with two opposed parallel contact surfaces.

o) Type 5 wad fragment.

p) Type 4 wad fragment.

q) Type 5 wad fragment.

r) Type 5 wad fragment.

s) Doubled up Type 5 wad fragment.

Fig. 107 *Kiln Group 1, c.1820: (t-v): Kiln Group 2, c.1865(w); 1980 stray find (x)*

t) Thin sheet fragment with one side scraped, the other with paper contact impression. Formed from Fabric 6.

u) Type 2 applied strip fragment, of triangular section, coated on two surfaces with white clay lute. Formed from Fabric 4.

v) Thin sheet fragment with one side scraped, the other with paper contact impression. Formed from Fabric 9.

w) Thin sheet, stem, slag laminate. The thin sheet is formed from Fabric 9.

x) Stem slag laminate.

Method used for the removal of iron staining from the pipes

J. Mirdamadi

The following method used was found to be very effective for the removal of iron staining from the pipes and may be of use in dealing with other groups of iron stained ceramics. The method employed was to soak the fragments in a 0.1M solution of ethylenediaminetetra-acetic acid (EDTA). The di-sodium salt (EDTA Na_2) was used, as the free acid is practically insoluble in water.

The solution was made up in tap water by dissolving 37.2g of the salt in each litre of water. Great accuracy is not

necessary. The clay tobacco pipe fragments were put into large deep trays and sufficient solution was added to cover them. It was found that 10 litres of solution was sufficient to submerge 6kg of fragments. The tray was covered to reduce evaporation and left for several days.

Each day the fragments were brushed with a soft tooth brush, and any clean fragments were transferred to clean water. After about one week the solution was very dark in colour, and the remaining fragments with stubborn stains were transferred to a smaller volume of fresh solution. This routine was repeated until the only fragments remaining were those resistant to further cleaning.

Meanwhile the rinsing routine was to place the fragments in running water for about one hour and then to soak each batch in a large volume of water in a bucket, the water being changed each day to remove the EDTA which had been absorbed by the fragments. The final soak on the fifth day was in deionised water.

It was found that most iron stain could be removed by this method, except where there was very heavy encrustation, a rough surface or cracks in the clay. Unfortunately the site code markings, presumably in india ink, were also largely removed since the majority of them had been applied over iron staining. Where the markings had been applied to a clean clay surface they were not affected by the EDTA.

There is no particular hazard from the chemical if used as above, but rubber or disposable gloves should be worn when brushing the fragments and care should be taken not to breathe in the dust when weighing out large quantities of the dry chemical.