



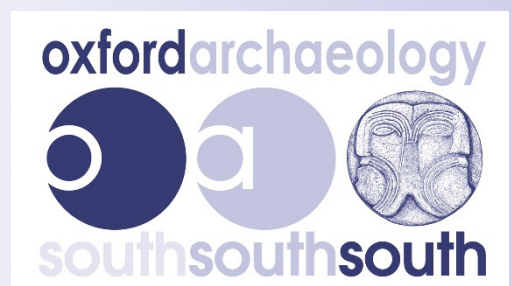
# The re-excavation of a 17<sup>th</sup> century stoneware kiln in Woolwich

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# The re-excavation of a 17th-century stoneware kiln in Woolwich

## *Publication report*

*Written by Edward Biddulph and John Cotter*

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## 1 INTRODUCTION

In 1974 a stoneware pottery kiln was excavated at Woolwich Ferry Approach (since redeveloped) in south-east London. It was dated to c. 1660 and is believed to be the earliest evidence for stoneware production in England, preceding John Dwight's 1672 stoneware pottery at Fulham by as much as a decade. The kiln was notable for its range of brown salt-glazed stoneware 'bellarmine' jugs. These are stylistically indistinguishable from *Bartmann* jugs imported from Germany, with many decorated with heraldic medallions and grimacing 'bellarmine' masks. There was evidence from the excavation, too, for attempts to produce highly decorated, blue-painted, Westerwald-style stoneware, though possibly in another, nearby, kiln. The original excavation took place in the autumn of 1974, and post-excavation work three years later. A report on the kiln and the 60,000-plus sherds of pottery recovered from it and a later earthenware kiln that was also found was published in 1978,<sup>1</sup> and an article on the pottery appeared in this magazine in the same year.<sup>2</sup>

As excavations came to an end, there was discussion about relocating the kiln, which was hoped would lead to the kiln's fuller investigation, preservation and eventual display. The go-ahead was quickly given, and the structure, once emptied of finds, was filled with protective polyurethane foam, isolated in a block of subsoil and natural Thanet sand, and confined within a wooden box with a steel framework base. Unfortunately, there was insufficient time to prepare the entire structure for lifting, and so the kiln was cut off at the end of the firing chamber, with the stokehole being left *in situ*. By April 1975, the kiln was ready to be moved. The 35-ton, room-sized crate was lifted by crane onto a lowloader and transported to a storage depot two miles away in the Borough of Greenwich.<sup>3</sup> Over the years, the block was moved three times and for the last seven years stood in a car park behind the Greenwich Heritage Centre (Figs 1 and 2).

The hoped-for funding for the preservation and display of the kiln remains never materialized, and so the landowners, Berkeley Homes Ltd, put forward funding to complete the excavation, recording and reporting of the kiln as a condition of planning. The re-excavation was carried out over a week in March 2017 by a team from Oxford Archaeology, 43 years after the original excavation (Fig. 3). The site staff welcomed a number of visitors to view the site, including members of the original 1974 excavation team. By the end of the week, the kiln had been excavated, recorded, sampled, and surveyed using photogrammetric techniques.<sup>4</sup> It was then dismantled and taken away for disposal.

Whether by accident or design, the block had been replaced in its original orientation, with the kiln aligned on a north-south axis, the narrower ('entrance') end pointing north towards the river Thames, and this orientation is retained in the description below.

## 2 THE KILN

The firing chamber of the kiln was oval in plan and measured c. 3.2m long – originally c. 5.4m long with the stokehole – and up to c. 2.35m wide (Fig. 4). The stratigraphic sequence of the kiln began with the construction cut (context 2) that was dug into the subsoil. The cut narrowed towards the base and sloped from north to south, being c. 0.8m deep at the south end of the chamber (Fig. 5). An earlier pit that had possibly been cut by the kiln – the relationship is unclear – had been preserved in the soil block. The pit produced abundant charcoal, three fragments of cattle bone, and 59 sherds of pottery from around 33 vessels, including wasters from an earlier kiln in the vicinity and two residual Roman-period sherds. The pit had been noted during the lifting of the kiln, when it served as a useful sump at times of rainfall,<sup>5</sup> but it is not apparently shown on the plans of the 1978 report. Another feature, a posthole, was recorded to the south of the pit. The posthole does not appear to have been excavated in 1974, although other postholes that had been recorded were thought to be associated with the kiln.<sup>6</sup> While no dating evidence was recovered from the feature, the posthole seen during the re-excavation may well belong to the same posthole group.

The sides of the construction cut were lined with bricks and the vertical elements of the internal features of the chamber, also brick-built, were inserted (context 1). The kiln wall survived best on the east side of the cut. The west side, which had been removed almost entirely by later rubbish pits, was limited to a stack of bricks present in 1974, but no longer extant in 2017, and a portion of the west side of the ‘entrance’ end. The east wall, a single brick wide, comprised at least nine courses of bricks where the kiln was deepest. The lowest courses were laid as stretchers (that is, with bricks laid longitudinally), while the bricks in the upper part of the wall were laid as headers (that is, with the ends facing). All were bonded together with a clay mortar, and the interior face of the wall was ‘rendered’ with clay.

Nine brick samples were retained and recorded in detail. All are ordinary handmade unfrosted red brick, presumably made on-site, and typically 215-235mm long, 105mm wide and 60-66mm thick. The bricks were made in a coarse, poorly mixed sandy brickearth fabric, and their thickness and general appearance are typical of most 17th-century bricks in London, including those from the Great Fire of 1666.

The most striking feature of the bricks from the kiln walls is the marked colour zoning, from inner to outer surface, caused by the intense heat of the last firing. This left the inner face of the wall, and all exposed surfaces of the firing chamber, brightly oxidised (orange) to a depth of c. 100-150mm, and beyond this a sharply demarcated zone of reduced dark grey or black extended into the surrounding ground to a maximum depth of c. 250mm. This zoned or ‘sandwich’ effect was most clearly seen on the surviving upper brick courses, particularly the uppermost course flush with the 1974 ground surface. The inner, orange, half of this was brittle, but relatively hard and intact, whereas the black outer half had crumbled away like soft charcoal.

Two pedestals and three flues were formed by inserting four walls a single brick wide, the bricks laid as stretchers (Figs 6 and 7). The walls measured up to c. 0.22m tall and were spaced at c. 0.25m intervals. The east and central flues were well-preserved and recorded in detail; the more damaged west flue was not investigated, but its course could be traced by the foam packing inserted prior to the relocation of the kiln (Fig. 4). A sandy silt soil, fired red by the use of the kiln, covered the base of the flues and infilled the pedestals and the gap between the external wall and the construction cut (context 3). The floor of the flues was then surfaced with sandy clay c. 30mm thick (context 11), while the tops of the pedestals



were capped with more bricks (context 12). Despite the apparent robustness of the construction, a crack visible across the east pedestal – also recorded in 1974 – points to structural damage after firing.

Brick samples from the base of the pedestals show that the bricks here are unusual in the variation of their thickness (up 70mm) and are soft, pale grey-brown, crumbly and easily scratched with the fingernail. The bricks were almost certainly unfired or only slightly heat-altered, like very soft fired clay objects, rather than true ceramic. The excavator during the 2017 investigation noted other apparently unfired bricks at the base of the east wall of the kiln. This raises the possibility that the kiln was made from unfired bricks, which were then given an initial firing to dry them out and bake them before they were ready to receive the first load of pottery. This initial firing may have been adequate to fire the upper courses of brickwork, but the lowest courses did not receive sufficient heat to be properly fired. This may explain why the external face of the kiln wall (that is, facing outwards into the natural soil) is so soft and black (Fig. 8b).

Five fire bars recorded *in situ* in 1974 were found intact on re-excavation in 2017 (contexts 13-17). Three of the surviving bars spanned the central flue, while the other two spanned the eastern outer flue. The ends of the fire bars rested on ledges and were bonded with clay luting and unfired clay buns. Brick ledges were seen on the sides of the east and west pedestals facing the central flue, while a slight ledge or thickening of the clay ‘render’ was visible on the inner face of the east wall. The outer bars were higher at the east wall end than the pedestal end, the pedestal and the kiln floor possibly having slumped somewhat in the intense heat of the last firing.

In cross-section the fire bars are roughly kidney-shaped or sub-rectangular, with the upper load-bearing surface being the flattest part (Fig. 8d). They appear to have been crudely rolled or built up from slabs of clay, and are c. 120-140mm wide, with the longest surviving to a length of 350mm. The bars are gently arched but the weight of the kiln load and the extreme heat of the last few firings flattened three of them, causing them to crack and buckle on the underside. The main cracks on all examples are roughly central and longitudinal and it is evident from glaze and firing colour differences that some bars had cracked or split and were subsequently re-fired. This is the main piece of evidence that the kiln was fired at least twice, although the first firing may simply have been to fire the kiln bars and an empty kiln. The bars were probably covered with a thick final coating or slurry of semi-liquid clay which subsequently crackled and crazed, particularly on the underside. The bars also have an accidental purplish-brown or grey ash/salt glaze, which is thickest on the underside where it covers the crackled clay slip.

Traces of squashed clay buns are dotted over the upper surfaces, some with impressions of square pads (Fig. 8c), and scraps of embedded pottery, including an inverted bellarmine neck. A near-complete, wheel-made stoneware kiln prop was found on its side on top of one of the bars, but may have slid onto it from the pedestal. This was one of 11 props recovered from the re-excavation (Fig. 8a), and as noted in the original report, probably formed the first layer of the kiln stack to keep the vessels from touching the kiln floor.

The brick capping of the pedestals and the fire bars formed the raised floor that carried the pottery load. This floor was coated by a thick vitreous slaggy crust of fired clay, sand, fused kiln-furniture and broken stoneware pottery, melted and slumped in places (context 4). Roof tile collected from the original excavation was suggested to have been used to cover vent holes in the roof of the kiln.<sup>7</sup> A further ten pieces of flat roof tile were recorded

during the re-excavation, but these had been set on their edge in a single or double row across the junction of the south end of the firing chamber and the stokehole, possibly to fill gaps that had opened up after the kiln's initial firing.

### 3 THE POTTERY AND THE DATING OF THE KILN

The date of the kiln still largely rests on the clay tobacco pipe dating of c. 1660-1680 from the original excavation and the excavator's reasonable argument that the kiln was short-lived and abandoned closer to c. 1660 than c. 1680. The re-excavation produced a further 100 sherds of pottery, weighing 2629g and with an estimated number of 57 vessels. All this is post-medieval (dating after c. 1480), apart from four sherds of residual late Iron Age and Roman pottery, and was fully catalogued using Museum of London form and fabric codes.<sup>8</sup> Most of the pottery from the pit that appeared to have been cut by the construction cut comprises jugs, bowls and jars in London early post-medieval redware (PMRE c. 1480-1650). Many of these are wasters from an earlier kiln. The 1974 excavations found large amounts of this ware, particularly in the backfill of a large square 'Tudor' pit thought to be a settling tank for potter's clay.<sup>9</sup> There is also a rim sherd from a small globular or barrel-shaped mug in black glazed redware (PMBL, c. 1580-1700) with decorative shoulder cordons or ribbing.

Ceramics from the construction cut infill included a single piece of clay pipe stem of broadly 17th-century date, the only piece of clay pipe from the re-excavation. The pottery included five sherds of glazed post-medieval redware (PMR). Unfortunately, these are not very diagnostic or closely datable, but the extensive use of glaze and the very plain, somewhat heavily-potted look of these pieces might suggest a date in the second half of the 17th century. All the PMR sherds have a fine grey sandy material adhering to them – probably bonded to them during the firing of the kiln – although they do not appear to be wasters themselves.

The crust layer above the raised floor yielded parts of 17 brown salt-glazed stoneware vessels, though fragments of several other vessels remained embedded in the vitreous surface or stuck to fire bars. The stoneware comprises parts of two globular drinking jugs with cylindrical necks both with characteristic ring-stamped decoration on the neck.<sup>10</sup> There were also rims and necks from seven bellarmine-type bottles or jugs with collared or pulley rims,<sup>11</sup> and rims from two brown salt-glazed ovoid mugs, a characteristic Woolwich kiln form.<sup>12</sup> These add very little to the published typology of these forms which was based on many more complete vessels than are present here. A few individual fragmentary vessels embedded in the floor were sampled during excavation and identified as Woolwich grey stoneware (WOOLGS) dating between c. 1630/40 and 1680. It is worth mentioning that none of the highly-decorated Westerwald-style stonewares (WOOLS) made at Woolwich and attributed to phase 1 production in the 1978 report were noted in the assemblage here.

## 4 SOME UNRESOLVED QUESTIONS

The 1978 report on the kiln concluded that ‘the stoneware kiln may have been built around 1660 or a little earlier and was demolished and backfilled around the early part of 1660 to 1680.’<sup>13</sup> The newly excavated pottery (and one piece of clay pipe) confirms a broadly mid-17th century date for the construction and use of the stoneware kiln, and provides additional evidence in the form of wasters for the existence of earlier earthenware kilns in the vicinity.

While the dating of the kiln could not be refined further,<sup>14</sup> its re-excavation nevertheless completed the archaeological record of the kiln begun 43 years earlier, and as a result much more is known about its construction. Questions remain, however. Though presumably covered by a brick arch, too little is known about the stokehole to the south of the firing chamber. The opposite end of the kiln, with its splayed opening, is also open to interpretation: did it function as a rather narrow loading entrance, or were the pots loaded from above and then covered with a temporary roof? That the kiln was an updraught kiln is fairly certain, with a heat source coming from the stokehole in the south and passing through the firing chamber. The heat probably escaped through a vent or vents in the roof, but some German kilns had a solid chimney stack or vent at the opposite end of the kiln. Could the ‘entrance’ be the remains of something like this? What of the individuals who built the kiln and operated it? Were German potters responsible for the pottery production represented by the stoneware kiln? And why was the kiln apparently short-lived? The mass of fused pottery, the cracks evident in the fire bars and firing chamber, and the slumping of the kiln floor and pedestal hint at structural failure that may have caused the kiln to be abandoned.<sup>15</sup>

## 5 ACKNOWLEDGEMENTS

The authors are grateful to Berkeley Homes (East Thames) Ltd for generously funding the excavation, and to Mark Stevenson of the Greater London Archaeology Advisory Service (GLAAS), Historic England, for his advice and support. Thanks are also owed to members of the 1974 excavation team who visited the site and offered their enormously helpful recollections. The original excavation was directed by Alice Pandrich. The re-excavation was carried out by Lee Sparks and Richard Harriss. Benjamin Brown undertook the photogrammetric survey and 3D modelling. John Cotter recorded the pottery, bricks, fired clay and stone objects. The figures were prepared by Markus Dylewski and Magdalena Wachnik. The project was managed by David Score. The archive will be deposited with the Museum of London under accession code WOK17.

## 6 ENDNOTES

1. S. Pryor and K. Blockley 'A 17th-century kiln site at Woolwich' *Post-Medieval Archaeol* **12** (1978), 30–85.
2. K. Blockley 'Post-medieval pottery production at Woolwich' *London Archaeol* **3** no. 6 (1978), 153–8.
3. J. Price 'The Woolwich project: the removal of a 17th century stoneware kiln' in R. Payton (ed.) *Retrieval of objects from archaeological sites* (1992), 93–104.
4. A 3D model of the kiln based on the photogrammetric survey is available to view on Sketchfab (<https://skfb.ly/699Vt>)
5. *Op cit* fn 3, 96.
6. *Op cit* fn 1, 39.
7. *Op cit* fn 1, 57–8.
8. MOLA 'Medieval and post-medieval pottery codes' (2014) <http://www.mola.org.uk/medieval-and-post-medieval-pottery-codes>
9. *Op cit* fn 1, 39–41.
10. *Op cit* fn 1, fig. 11.40.
11. *Op cit* fn 1, figs 10.32-34, 11.36-37 and 11.41-42.
12. *Op cit* fn 1, fig. 11.38.
13. *Op cit* fn 1, 61, 63.
14. Samples were apparently taken from about eight bricks in 1974 for archaeomagnetic dating, but the results of this do not seem to have been published.
15. A note on the re-excavation of the kiln appears in the Medieval Pottery Research Group Newsletter (J. Cotter 'The re-excavation of the Woolwich stoneware kiln (c 1660): an interim summary' *MPRG Newsletter* 87, 2–4).

## APPENDIX A FINDS REPORTS FOR ARCHIVE

### A.1 Ceramic finds: Introduction and methodology

*By John Cotter*

This is an assessment of the ceramic finds (pottery, kiln furniture and brick) from the 2017 re-excavation of a 17th-century stoneware kiln found at Woolwich Ferry Approach in 1974 (Pryor and Blockley 1978). Owing to limited funding a detailed record and catalogue of all the finds (which fill 18 museum boxes) has not been possible and it is hoped that this will one day be carried out. Any future work should also include the re-examination of the kiln material from the 1974 excavation - the quantities of which dwarf the amounts reported on here. It must be admitted, however, that the usual sherd counts and weights normally recorded for 'loose' ceramic material do not carry quite the same significance here. All the pottery and kiln furniture recovered from the kiln in 2017 was actually fused together into a vitreous slaggy 'crust' that covered the raised kiln floor and fire bars and was, in effect, part of the actual kiln structure as found. Therefore, the items of pottery etc considered here are simply those that the excavators were able to detach while on site. Many other fragmentary vessels, objects and scraps remain embedded in the samples of slaggy crust retained for analysis (present or future) and attempts to individually 'quantify' these are likely to be futile as they are really all pieces of one object - the kiln itself. The small quantity of 'loose' pottery from the kiln, and from surrounding features (some earlier in date), has nevertheless been fully catalogued (see below). A representative sample of bricks has also been catalogued. Loose items of kiln furniture, and the detached kiln bars, were visually scanned, sketched and sometimes photographed, and the results presented here. The detailed photographic record made of the re-excavated kiln at the time explains the nature of the discovery far more eloquently than any of the finds reports below - although these contribute to a fuller understanding of it.

Any future work should also include a thorough re-examination and comparison of the original 1974 site records relating to the kiln excavation - as questions about its structure and function still remain. While the original report is an excellent summary of the c 60,000 sherds recovered and the two kilns excavated (one earthenware, one stoneware), the published description of the stoneware kiln itself is actually quite sparse, and no cross-sections were undertaken. Details of the brick 'stoke hole' (at the southern end) - its form and appearance - are passed over, except a mention that it had to be excavated horizontally and underpinned before the kiln could be block lifted. This end of the kiln was too damaged by the block-lifting process and unfortunately the re-excavation could make only limited sense of what little remained of the stoke hole area. It is to be hoped the original site records will allow a better understanding of this important and now lost feature.

For the last few years of its existence the kiln was located in the car park behind the Greenwich Heritage Centre (Postcode SE18 6FR). Whether by accident or design the kiln was replaced in almost exactly the same orientation in which it was originally found - aligned due north-south with its (missing) stoke-hole facing south - away from the Thames.

## A.2 Clay tobacco pipe

*by John Cotter*

The excavation produced a single piece of clay pipe which is fully described below:

***Context [3]. Fill of construction cut [2] for the stoneware kiln): Pipe date broadly 17th Century***

One piece (4g). Pipe stem fragment 38mm long. Typical 'chunky' 17th-century-type stem with a bore diameter of 3mm and stem diameter of 8-9mm. Very fine off-white fabric with burnished surfaces. Some patches of grey-brown surface discoloration, probably post-deposition. Fairly fresh condition. The same context produced sherds of 17th-century pottery (PMR). This adds nothing to the established dating of the kiln.

## A.3 The pottery

*By John Cotter*

The excavation produced 100 sherds of pottery weighing 2629g and with an estimated number (ENV) of 57 vessels. The pottery was fully catalogued using the form and fabric codes of Museum of London (MoLA 2014). All of this is post-medieval (after c 1480) apart from three small sherds of residual Roman pottery and one sherd (21g) of Late Iron Age/Early Roman pottery. Full details remain in archive. The pottery came from just four contexts. Two of these (including the 59 sherds from [8]) lay outside the footprint of the kiln and did not contain stoneware or clay pipes. A few pieces of ceramic building material (CBM) are also mentioned here if they have a bearing on dating or provide additional evidence for the local ceramic industry.

The stoneware kiln itself had been thoroughly emptied of any loose pottery and kiln-furniture during the original 1974 excavation and this was fully reported on in the subsequent report (Prior and Blockley 1978). Clay tobacco pipes recovered during the original excavation of the stoneware kiln were dated c 1660-1680, which is also the *terminus post quem* given to the slightly later earthenware kiln which cut it. It seemed likely, therefore, "that the stoneware kiln may have been built around 1660 or a little earlier and was demolished and backfilled around the early part of 1660 to 1680, since the Phase three [earthenware] kiln was built, used and possibly re-built before its destruction in the latter part of 1660 to 1680" (ibid., 61, 63). The newly excavated pottery (and one piece of clay pipe) broadly confirms a mid-17th century date for the construction and use of the stoneware kiln and provides additional evidence - in the form of wasters - for the existence of earlier earthenware kilns in the vicinity. This key new dating evidence is summarised below.

***Context [3]. Fill of construction cut [2] for the stoneware kiln (c 1650-1700?):***

This comprised the fire-reddened fill at the base of the flues and the soil infilling of the brick pedestals capped by the crust of the kiln floor. Very little of this survived and was only seen clearly at the southern (stoke-hole) end of the kiln. The excavators considered the few finds from here to be the most significant in terms of dating the kiln as they were definitely contemporary with it (even if they might be redeposited). The finds included a single piece of clay pipe stem of broadly 17th-century date - the only piece of clay pipe from the new excavations. The pottery comprised only 6 sherds (151g) from the same number of vessels



although one of these was a residual Roman sherd. The remaining 5 sherds are in glazed post-medieval redware (PMR). These are all plain and include the rim of a wide bowl, a flanged-everted storage jar rim with an external glaze, and a jug handle with all-over greenish-brown glaze. Unfortunately, these are not very diagnostic, or closely datable, but the extensive use of glaze and the very plain, somewhat heavily-potted look of these pieces might suggest a date in the second half of the 17th century (roughly c 1650-1700). All of the PMR sherds have a fine grey sandy material adhering to them - probably bonded to them during the firing of the kiln - although they do not appear to be wasters themselves. The context also produced three smallish pieces of CBM, also probably 17th-century. These included a scrap of brick and two pieces of peg tile including a corner fragment with a large patch of brown glaze on the underside (used as kiln-furniture?).

***Context [8]. Fill of Pit [7] (c 1580-1650, possibly c 1630-1650/60?):***

This pit lay to the north-east of the kiln and appeared (in plan) to be cut/truncated by the construction cut for the kiln [2]. It produced 59 sherds of pottery (1635g) from around 33 vessels including two residual Roman sherds. The fill also contained a high volume of charcoal and the number of pottery wasters it contained suggests it derives from at least two earlier unlocated kiln in the vicinity. The latest group of pottery (PMR) in the pit suggests a date of c 1580-1650. There is also a rim sherd from a small globular or barrel-shaped mug in black glazed redware (PMBL, c 1580-1700) with decorative shoulder cordons or ribbing. While this form has some parallels elsewhere from as early as c 1600, it was much commoner in the mid- to late-17th century, in Border whitewares for example (Pearce 1992, Pl. 3), and also in London tin-glazed wares. In this case a date of c 1630-1650/60 might be suggested. Amongst the ceramic building material from this pit is a black glazed peg tile which bears a stacking scar from the base of a mug or jug (see below). This suggests that black glazed redware vessels, similar to the mug rim just described, were being made nearby. There are four vessels in post-medieval redware (PMR), also dating from c 1580 onwards, three of which are wasters with glaze over the breaks. Most of the pit assemblage comprises jugs, bowls and jars in London early post-medieval redware (PMRE c 1480-1650) including white-slipped vessels with green or yellow glazes (various sub-codes). Many of these are clearly wasters too and probably residual by now. The 1974 excavations also found large amounts of this ware (their Fabric E1) all over the site, particularly in the backfill of a large square 'Tudor' (Phase 1) pit thought to be a settling tank for potter's clay (P&B78, fig. 2 and 5).

Two vessels from [8] are in a fine sandy orange-buff fabric identified here as London post-medieval calcareous redware (PMR CALC, c 1580-1900, or just possibly Surrey/Hants Border ware: BORD, c 1550-1700). One of these - certainly one of the most unusual vessels from the site - is a tall cylindrical vessel, that might have been identified as a water-pipe, but as it is heavily soot-blackened all-over inside it can only be identified as a chimney pot. The vessel is unglazed but has a few accidental spots of green glaze externally. Purpose-made chimney pots (as opposed to brick chimney stacks) are remarkably uncommon during this period (c 1580-1650?) and it could be that this is no ordinary domestic chimney pot from the roof of a house but, perhaps, a pot or vent designed for a pottery kiln? This could have been fixed to the temporary dome of the kiln or to a brick chimney stack or flue designed to vent the hot gases escaping from the kiln and, perhaps, to improve updraught? In the original stoneware kiln excavation report a complete vessel described as a "chimney" [12] was found in the otherwise unexcavated construction trench [11] for the kiln (ibid., 39), but this is not

described further, or illustrated. However, another chimney pot (not illustrated) is described as coming from the subsequent Phase 3 earthenware kiln excavations: “Fabric M1...one vessel represented by two sherds in a buff sandy fabric. The vessel has straight sides, a simple rim and was not produced locally” (ibid., 72). This, like a few other wares, may have been intrusive or residual in this phase. An examination of the original material would be needed to check if these are all in the same fabric. The CBM from this pit (42 pieces) included three pieces of peg tile used as kiln-furniture (including the black glazed piece described above). The rest comprised pieces of early post-medieval peg tile and brick including a complete ‘Tudor’ brick. Another brick corner was scorched and bore traces of a fritty glaze suggesting it may have come from a kiln.

***Context [4]. The raised floor of the kiln covering the two pedestals (c 1650-1700?):***

A thick vitreous slaggy crust of fired clay, sand, fused kiln-furniture and broken stoneware pottery, melted and slumped in places; aptly described in the original report as: “the fused conglomerations of pottery and kiln” (ibid., 41). Most of this has been treated in the present report as ‘fired clay’ or (if detached) as ‘kiln-furniture’ (see below). A few individual fragmentary ‘vessels’ from here were detached or sampled during excavation. These are all in Woolwich grey stoneware (WOOLGS). This fabric, like the kiln itself, is only approximately dated by the stylistic features of the complete vessels (bellarmine bottles etc) excavated in 1974 and by the date-range applied to Woolwich Ferry white stoneware (WOOLS) in the Museum of London fabric coding system (MoLA 2014), which is also very general. The true date of production could be any between c 1630/40 to 1680 (although the clay pipes suggest c 1660-1680). The kiln floor yielded parts of 17 brown salt-glazed stoneware vessels (35 sherds, 822g). Parts of several other vessels however remain embedded in the kiln floor samples or stuck to fire bars. Vitriified or cindery lumps of kiln floor adhered to most items here. The ‘vessel’ stoneware comprises parts of two globular drinking jugs with cylindrical necks both with characteristic ring-stamped decoration on the neck (P&B78, fig. 11.40). There were also rims and necks from seven Bellarmine-type bottles or jugs with collared or pulley rims (ibid., fig.10.32-34, fig.11.36-37, 41-42). And rims from two brown salt-glazed ovoid mugs - a characteristic Woolwich kiln form (ibid., fig.11.38). These add very little to the published typology of these forms which was based on many more complete vessels than are present here - hundreds in fact. Only one Bellarmine bottle here showed traces of an applied mask below the rim (also one embedded in the crust sample). Aside from these, no characteristic Bellarmine masks or applied medallions were noted from the new excavations - whether in the sample here or from the many other broken vessels left embedded in kiln floor. The differences in the depths of the ‘bellarmine’ collared rims here probably indicate vessels of different sizes and not all of these may have been provided with a bellarmine mask. Bottles without masks and/or medallions are described in the original report. It is also worth mentioning that none of the highly-decorated Westerwald-style stonewares (WOOLS), made at Woolwich, were noted in the assemblage here. These are thought to have been made in a kiln nearby.

***Context [6]. Pre-kiln layer (Iron Age/Early Roman):***

Made ground underlying construction cut [2] for the kiln. Produced a single body sherd (21g) of handmade soft grey pottery of Late Iron Age/Early Roman date. Possibly residual?

## A.4 Kiln furniture

*By John Cotter*

This material was scanned and noted but not catalogued in detail. No new types of kiln furniture were recovered from the stoneware kiln and one type was completely absent - no doubt because the kiln cavities had been emptied in the 1974 excavation. Nearly all the portable kiln furniture described here is from Context [4] - the solid vitrified clay crust covering the two pedestals and the fire bars. There is no real way to disentangle or distinguish and adequately quantify items of kiln furniture (some bonded together by the potters) from fragments of stoneware pottery embedded in the same crust and the items quantified here are those larger pieces which the excavators were able to detach. Many smaller scraps of kiln furniture and pottery left embedded in the crust, or fused to other larger items of kiln furniture, are not included here. These include a few lumps of the crust taken as a representative sample of this feature and the items fused to the kiln bars (see below). The commonest and most robust items of kiln furniture are the red clay 'buns' and the square stoneware 'pads' placed on top of the latter which in turn bore the weight of the pottery load. There are also the wheel-thrown stoneware conical 'props' which also sat on buns or directly on the raised kiln floor (crust). Although the re-excavation revealed many complete and broken prop bases *in situ* these, owing to their fragility, did not survive as well as the other types on detachment from the crust. Despite an initial impression of disorder and random distribution of the objects embedded within, or onto, the crust, it was observed (in suitable lighting conditions) that there was some kind of order to the positioning of the kiln-furniture: on the widest parts of both pedestals the buns were roughly arranged in four, or possibly five rows, down the length of the pedestal. These may have slid or slumped a little during the last firing (especially towards the rear of the kiln) but the arrangement was still fairly obvious to observers. This feature was not mentioned in the original report and is not evident from the original published plan - although it may have been noted in site records at the time. Seven types of kiln furniture were distinguished in the original report as follows:

### ***Square Pads (Types 1 and 2)***

Fifty-four examples recovered, plus many smaller scraps (compared with 1,624 examples from the 1974 excavation). These are grouped together here as only one example is small enough to rate as Type 1 (40mm x 40mm x 6mm thick, Pryor and Blockley 1974, fig. 11.43). All the others are larger than this and thus fall into Type 2 'large pads of various sizes' (*ibid.*, fig. 11.47-48). Those here are generally smallish and often rectangular as well as square - all roughly cut and uneven, and many cracked or deformed during use. Examples noted include the following sizes: c 40mm x 45mm (several), 40mm x 50mm, 48mm x 54mm, and 60mm x 65mm. Nothing larger than this was noted and certainly nothing as large as the rare slab-like pad from 1974 (*ibid.*, fig. 11.48). As the original report noted, these are in a grey stoneware fabric and cut from a block of leather-hard clay using a potter's bow or wire thus leaving parallel ripples on the surfaces of many. Most bear an accidental salt glaze apart from the circular area where the pot rim or base was stacked. It is assumed here that they were fired before use - otherwise they could not have borne the weight of the kiln load upon them. Most show rim stacking impressions - mostly from bellarmines with rim diameters in the c35-40mm diameter range. A few of the larger pads have impressions from jugs or mugs with rim diameters in the c 60-80mm range - these larger rim impressions are generally off-centre and would have extended

over two or more pads. The weight of the load during firing would, as well as the softening effect of the extreme heat, have caused the stacked vessel to leave such an impression, which in some cases is quite deep. On few pieces there is a second fainter stacking impression on the 'underside' of the pad; this might have been caused by reuse or it might be evidence that the pad was used to separate two rim-to-rim vessels in the kiln stack (vessels which could include the conical props, which also left rim impressions). Smaller square pads were often supported by a single clay bun, but the buns were sometimes squashed to accommodate three or more pads which sometimes extended onto adjacent buns (see below).

### ***Buns (Type 3)***

Thirty-one examples noted (compared to 170 recovered in 1974). These are only briefly described in the original report (*ibid.*, 57, fig. 11.44-45). As the report noted they were probably used to level up differences in height of the layers of vessels being loaded into the kiln. These seem to have been formed from a lump of red clay - of the type used for roof tiles - and which the potter twisted into a crude bun- or ball-like form about the size of a duck egg or a tennis ball. They were probably placed unfired into the kiln and dotted or all over the raised kiln floor and fire bars (and perhaps higher up in the pottery stack?). Some appear to have sat on a bed of white sand. They appear to have been arranged in rows down the length of the main pedestal surfaces and then randomly wherever required. They have often been squashed or deformed to fill nooks and crannies and used as wedges to strengthen the bond between the clay kiln bars and brickwork. Two or more buns were occasionally stacked or squashed one upon the other (counted here as one object). They were further deformed during the firing process and some appear to have expanded like bread or pumice - sometimes breaking through the floor of the vessel stacked upon them (see Type 5 below). Most have a thin ash/salt glaze and they vary in colour from purplish-red to dark grey. A few buns have what looks like faint concentric wire marks on top, this appears to be an impression of the underside of a wheel-thrown prop or bellarmine jug.

### ***'Blobs' of fired clay (Type 4)***

Mostly small triangular blobs. None of these were noted from the re-excavation.

### ***Wheel-thrown kiln props (Type 5)***

Eleven examples noted (some possibly joining) (compared to 55 recovered in 1974). As noted in the original report, these probably formed the first layer of the kiln stack to keep the vessels from touching the kiln floor. The bases sat on a layer of sand, although some were clearly placed on the buns described above. These are in the same wheel-thrown grey stoneware fabric as the bellarmine jugs etc and similarly salt glazed. Smaller sherds from the props are not easily distinguished from the pottery. The form is a smallish slightly conical or cylindrical vessel with a plain flat base and a thickened or slightly beaded rim. The original report illustrated a single example (*ibid.*, fig. 11.46) and the more fragmentary examples from the new excavation are all very similar to this. Most were found broken *in-situ* but the complete bases of a couple of props survived and one complete profile could be reconstructed (height 90mm, base diameter c 60mm, rim diameter uncertain but less than the base). The latter lay on its side at the eastern end of Kiln Bar [15] but had probably slumped or slid off the pedestal during the last firing (it is possibly shown on the 1974 plan and photograph, as well as the recent photographs). A common feature of these objects (noted in the original report) is that

the thin flat bases have cracked during firing. The new material includes two completely detached base floors which survive as thin, scorched, salt-glazed pottery discs with concentric wire-marks on the underside. Others appear to have exploded in a radial fashion due to the force exerted by the expanding clay bun on which they were stacked; in other examples the bun appears to have broken through the thin base and intruded upwards, like foam or lava, into the cavity of the prop (also noted inside some bellarmine necks).

The original report noted that the conical kiln props had the same fabric as the bellarmines etc, but with the addition of abundant inclusions of black flint (to withstand the firing temperatures). No flint however was noted in any of the examples here - the only black inclusions appeared to be reduced iron compounds. A check on the original material would be required to resolve this anomaly.

### ***Kiln bars (Type 6)***

Five kiln bars were found *in-situ* in 1974 and were found intact and perfectly preserved on re-excavation in 2017 (Contexts 13-17), preserved by the foam packing around them. Originally there must have been other bars but these have not survived. The description in original report is very brief - simply describing that they spanned the gaps between the kiln floor (the two pedestals) and the side walls of the kiln (Context 1) and that they had an earthenware fabric with a coating of salt glaze derived from the firing (*ibid.*, 57). They were bonded to, and part of the physical structure of the kiln, rather than portable objects. Three of the surviving bars spanned the northern part of the central flue between the two pedestals (Bars 13, 14 and 15). The other two (Bars 16 and 17) spanned the gap over the outer flue between the eastern pedestal and the eastern side wall of the kiln. This was the only area of the side wall that survived intact enough to show that the outer bars were luted (bonded with clay) to a slight ledge or thickening of the clay lining on the inner face of the outer wall. The latter continued upwards for a few more courses (five?). It is curious that the row of bricks that these two fire bars seem to have been attached in the outer wall seems to have crumbled away along its entire surviving arc. There is a possible trace of another fire bar junction further north along the same crumbled row. The loss of this row (or its inner face) might have been caused by the detachment of the other (now vanished) fire bars, but whether this was deliberate or just the result of natural decay one cannot say. At the western junction where Bars 16 and 17 join the brick pedestal they do not seem to be flush with the top course of bricks, as one would expect, but seem to join at least one course down. It appears likely, however, that this part of the pedestal and kiln floor above may have slumped somewhat in the intense heat of the last firing into a vitreous slaggy mess - taking the upper course of bricks and the fire bars down with it.

In cross-section the fire bars are a little like bellarmine jug handles - roughly kidney-shaped or sub-rectangular with the upper load-bearing surface being the flattest part. They are gently arched but the weight of the kiln load and the extreme heat of the last few firings has flattened three of them, causing them to crack and buckle on the underside. The main cracks on all examples are roughly central and longitudinal and it is evident from glaze and firing colour differences that some bars had cracked or split in antiquity and were subsequently re-fired. This is the main piece of evidence that the kiln was fired at least twice - although the first time may have simply been to fire the kiln bars and perhaps an empty kiln?

The kiln bars were removed and kept for more detailed recording, and posterity. Kiln bar 17, however, broke into several pieces. Kiln bar 16 survived to a length of 350mm and two other to 295mm long (including vestiges of the bricks they were bonded to). On average the

bars are c 120-140mm wide. They are made from a fine reddish brick-like fabric with sparse very coarse flint inclusions. Unlike kiln bars from some Roman and medieval pottery kiln they were not formed around a central wooden withy or branch but appear to have been crudely rolled or built-up from slabs of clay. Unfired clay buns were sometimes used as fillers to bond the ends to the brickwork. They were probably covered with a thick final coating or slurry of semi-liquid clay which subsequently crackled and crazed - particularly on the underside. All the bars are covered with an accidental purplish-brown or grey ash/salt glaze which is thickest and crackled on the underside where it covers the crackled clay slip. Traces of squashed clay (Type 3) buns are dotted over the upper surfaces, some with impressions of square (Type 2) pads, and scraps of embedded pottery including an inverted bellarmine neck stuck near the end of Bar 16. A near-complete stoneware kiln prop (Type 5) was found on its side on top of Bar 15 but may have slid onto it from the pedestal. No other finds of kiln bars are mentioned in the original report, so presumably no detached examples were found in the loose fill.

### ***Roofing tiles from the kiln structure***

The 1974 excavation produced ten pieces of roof tile (with a patchy salt glaze) used as kiln furniture (Type 7). It was suggested that these may have been used to cover vents holes in the dome of the kiln and not as *bona fide* kiln furniture used within the kiln (ibid., 57-8). The ten new pieces of flat red roof tile (peg tile) from the re-excavated kiln are not kiln furniture, as such, but are part of the actual kiln structure - as the site label indicates ('tile, structural'). The nine fragments (1458g) from Context [1] comprise large fresh joining pieces from at least two peg tiles. One has preserves a complete width (150mm) and another has traces of a ?square nail hole. These are almost certainly from the row (or double row?) of on-edge (pitched) tiles which can be seen on site photographs at the very back (south end) of the eastern pedestal. They appear to have been used as fillers between the top of the pedestal wall and the final (east-west) line of bricks visible at the very southern end of the surviving kiln - these are probably part of the 'front' (stoke hole) wall of the kiln - although the precise nature of this area is somewhat vague due to poor preservation. The tiles were set on-edge in the same scorched clay 'mortar' (still adhering) used to bond the brickwork, but the mortar layer is very thick in comparison, to compensate for the size of the gap. Whether the tiles were part of the original structure or a later repair cannot be determined. They are grey and have been re-fired to a near-stoneware hardness throughout with a dark grey ash/salt glaze on the upper edges exposed to the heat of the kiln chamber. One piece has a possible glaze stacking scar on one of its flat sides but this was probably acquired before its use (or re-use) in the kiln here. Another smallish fragment (78g) of red tile from the kiln floor [4] has a rough black (denatured) glaze with a possible stacking scar from a vessel or piece of kiln furniture; its presence here may be accidental.

## **A.5 Bricks**

*By John Cotter*

All but a few bricks from the kiln have been heat-altered by at least two firings. Nine samples were retained and recorded in detail. Basically they are ordinary handmade unfrosted red brick, presumably made on-site. It is suggested below that the kiln was constructed of unfired (but dried-out) brick and clay kiln bars which were then given an (empty) initial firing before

any subsequent firings loaded with pottery. Six complete, typical, samples have the following dimensions: Length 215-235mm, Width 105mm, Thickness 60-66mm. They are roughly formed with creased surfaces and coarse vegetation impressions on the underside (including grass/straw impressions up to 150mm long). The vegetation impressions result from the drying process when the freshly moulded brick was placed on the ground, or a rough surface. Traces of mould impressions are seen on the underside of one or two examples. They have a coarse poorly mixed sandy brickearth fabric with sparse pebbles of grey-brown flint up to 40mm across. Swirls of grey and brown clay can be seen in some, as well as coarse reddish-brown or dark grey iron-rich clay pellets and iron oxides. This conforms with London brick Fabric 3033 and (apart from the re-firing), their thickness and general appearance is typical of most 17th-century bricks in London, including those from the Great fire of 1666.

The most striking feature of the bricks from the kiln walls (clearly visible in the site photographs) is the marked colour zoning, from inner to outer surface, caused by the intense heat of the last firing. This left the inner face of the wall, and all exposed surfaces of the firing chamber, brightly oxidised (orange) to a depth of c 100-150mm, and beyond this a sharply demarcated zone of reduced dark grey or black extending beyond the brick wall and floor and out into the surrounding ground to a maximum depth of c 250mm. This zoned or 'sandwich' effect was most clearly seen on the surviving upper (header) brick courses of east kiln wall particularly the uppermost course flush with the 1974 ground surface: the inner, orange, half of this was brittle, but relatively hard and intact, whereas the black outer half had crumbled away like soft charcoal. These had obviously been worn away to some extent (in 1974) by human feet, but this only exposed the marked differences already present. This sandwich-like effect is similar to that seen in the broken sections of pottery sherds from kiln sites and is usually attributed to short interruptions in the firing conditions; the reduction-oxidation chemistry that causes these effects in pottery must be somewhat similar to that seen in the bricks here. Bricks from the kiln wall were bonded together with a clay mortar (now red-brown) containing some flint gravel. No lime mortar was employed. This sort of mortar is often seen in medieval tile-built kilns, including medieval pottery kilns from recent excavations in Woolwich.

The four brick samples (Samples 1-4) from the east wall are from stretcher courses below ground level which survived better than the header courses above. These exhibit the same marked zonation - but longitudinally. On each of these the stretcher face, facing into the kiln chamber, has a dark grey-brown crust of ash/salt glaze from the thin clay lining applied all over the inside of the wall. Behind this is a broad oxidised orange-buff band, then a thin yellow-grey boundary before the final, outer, dark grey band. Brick Sample 5, a header brick from the pedestal, has an inner scorched crust of clay lining up to 20mm thick. It is zoned, like the top courses of the east wall, but the zoning is less marked and somewhat slanted or tilted - reflecting its position relative to the firing chamber. Sample 6, a very brittle stretcher, also from the pedestal wall, likewise shows a very scorched and cracked internal crust suggesting it came from the hottest part of the surviving kiln flues.

Brick Samples 7 and 8, from the base of the pedestal, are clearly unusual. They show unusual thickness variation (up 70mm) are soft, pale grey-brown, crumbly and easily scratched with the fingernail. They are almost certainly unfired or only slightly heat-altered - like very soft fired clay objects rather than true ceramic. The excavator noted other apparently unfired bricks at the base of the east wall of the kiln. This raises the interesting possibility that the kiln was made from unfired bricks and unfired clay fire bars which were then given an initial firing to

dry them out and bake them before they were ready to receive the first load of pottery. This initial firing may have been adequate to fire the upper courses of brick, but the lowest course of foundation bricks may have been too distant from the firing chamber to be properly fired. This might, possibly, explain why the external face of the kiln wall (facing outwards into the ground) is so soft and black - perhaps because it was too far away from the heat to be properly fired? Brick Sample 9, again from the east wall, is a damaged brick end that was core-sampled (drilled) in 1974, one of about eight thus cored, apparently to refine the archaeomagnetic dating curve for this part of the 17th century (based the pottery and clay pipe dates). The results of this do not seem to have been published.

## A.6 Stone object

*By John Cotter*

### *Context [3]. Fill of construction cut [2] for the stoneware kiln*

1 piece (172g). Flat slab-like fragment 24-25mm thick. Max length 80mm. Dense ironstone or fine-grained quartzite? Dark purplish-brown with darker iron-rich banding or layering within. Fairly smooth on both surfaces but smoother on one than the other. Edges fairly worn/abraded. No definite evidence of use apart from possible smoothing. Possibly natural?

## A.7 Animal bones

*By Lee G. Broderick*

A total of 3 animal bones were recovered from the site, all from a single pit abutting the kiln on its northwest side and possibly cut by it and collected by hand.

The specimens were generally in poor condition but it was possible to identify them all as from domestic cattle (*Bos taurus taurus*). These were a part of a left side femur shaft, part of a left astragalus and part of the fused distal end of a left humerus. The latter fuses between 3½ and 4 years, demonstrating that the animal was fully mature at the time of its death. No pre-depositional taphonomic indicators such as butchery marks or gnawing were observed but these may have been obscured by sub-aerial weathering.



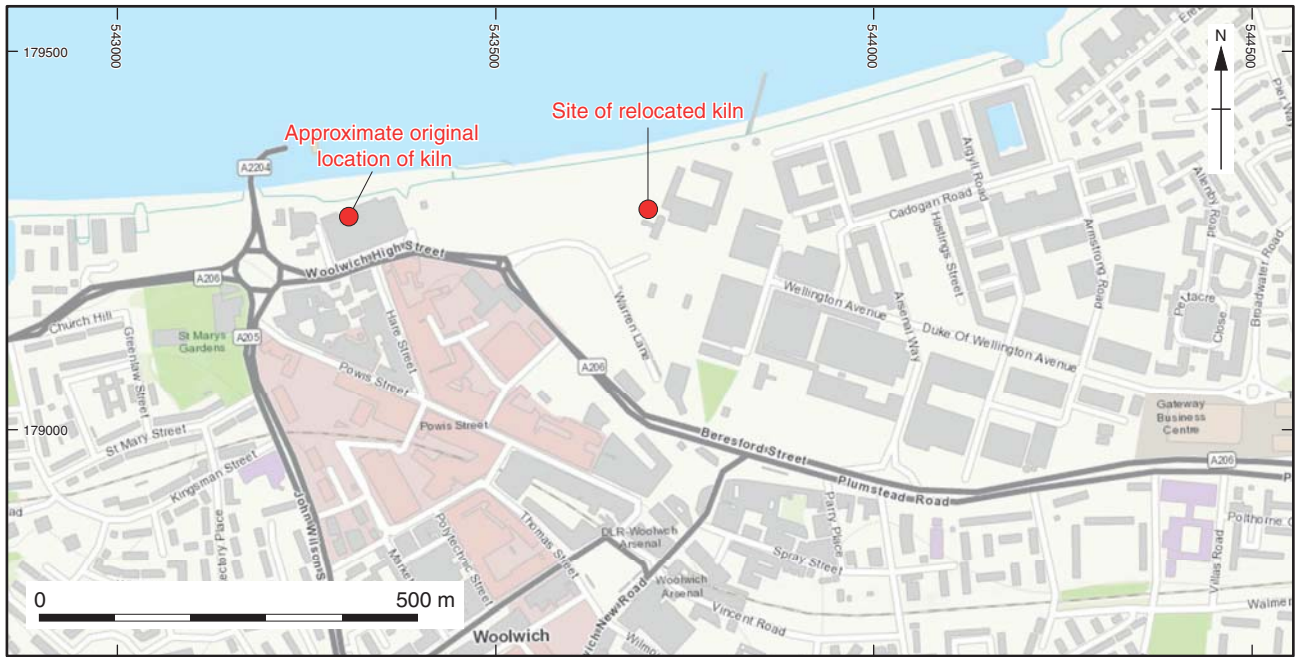


Figure 1: Location of the site



Figure 2: The soil block in its final location



Figure 3: Excavating the soil block

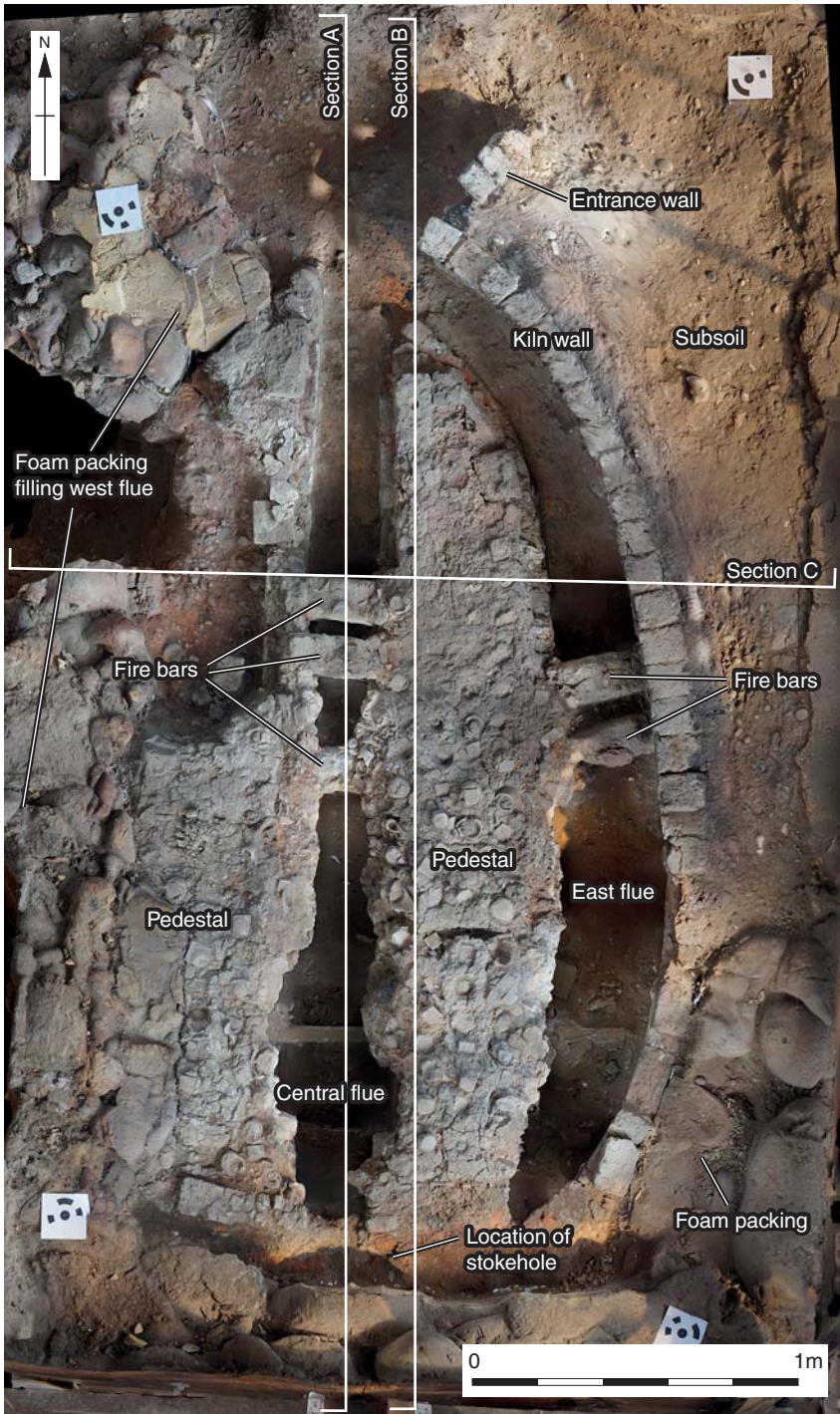


Figure 4: Plan view of the kiln taken from the 3D photogrammetric model

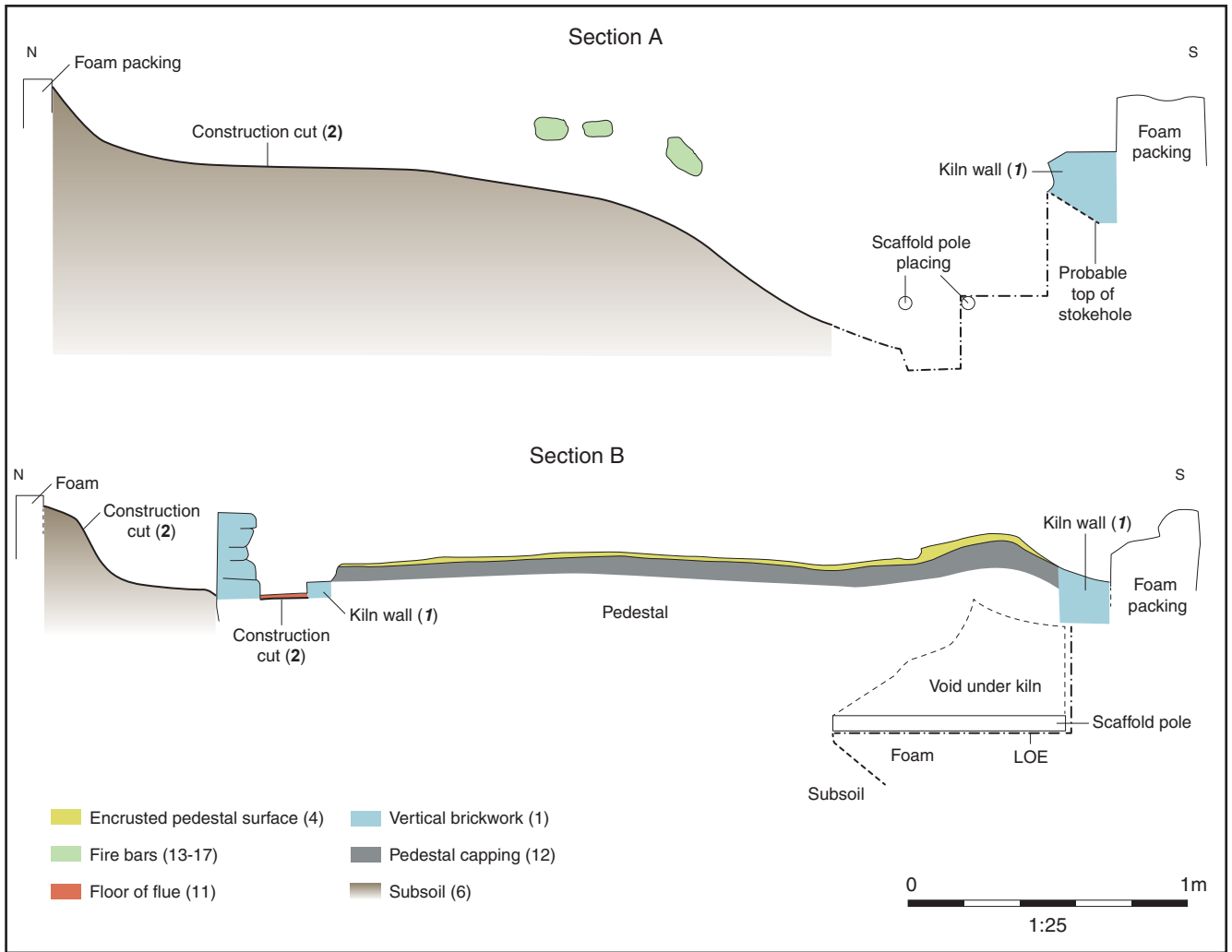


Figure 5: Two profiles running north-south through the kiln, section A through the central flue, section B through the east pedestal

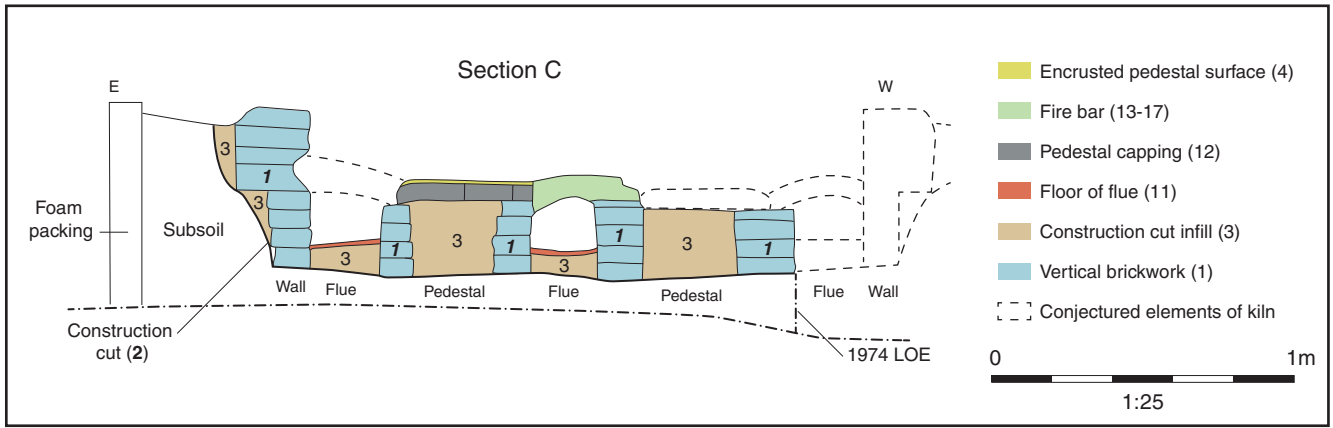


Figure 6: Interpretative north-facing section through the firing chamber of the kiln



Figure 7: View of north-facing section through the firing chamber of the kiln. Note the differentially fired bricks of the kiln wall



Figure 8: Selection of ceramic finds; a) bases of two stoneware conical props; b) brick from kiln wall showing zoned firing colours; c) group of square pads with impressions of vessels; d) kiln bar; note attached kiln furniture 'buns'





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