

Fig. 1: (left) site location; (right) area of investigation

From Salt Petre Bank to Dock Street: post-medieval glass manufacture in Tower Hamlets

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Introduction

Pre-Construct Archaeology was commissioned by Sterling Partners to undertake archaeological excavations at 15 Dock Street before redevelopment as residential property. After an initial evaluation and watching brief, the excavation of a single open area was carried out between 22nd August and 28th September 2005; the area of investigation measured 214m² (Fig. 1).

The ground works for the redevelopment of the site were not of sufficient depth to noticeably impact the underlying natural deposits. Although no culturally modified material was seen in the deepest exposures (a layer of sandy gravel), overlying horizons of similar material contained finds dating from the Roman to medieval period and have been

interpreted as phases of made ground. Several cut features penetrating through these layers date from the medieval period and reflect the site's position in a landscape dominated by farming. Evidence from the post-medieval period pre-dating the Great Fire of 1666 is limited to several pit cuts, this likely being the result of the intense quarrying of brickearth that took place here.

The establishment of a glassworks dominated Saltpetre Lane (later to become Dock Street) from the mid-17th to early 19th century. These developments are well documented in historical records.¹ Indeed, it appears that this area of London entertained several glasshouses that, along with other industries that relied on hot working, were deemed a threat to the fire-ravaged city.

Prehistoric and Roman activity

There have been many archaeological interventions in Dock Street over recent years, but there have been few finds, features and deposits from the prehistoric period. Whilst flint flakes, axes and pottery have been found at sites on The Minories, Mansell Street and Royal Mint Street² (all to the west), no activity from this period has been seen along Dock Street. During the Roman period, Dock Street was situated approximately 500m from the eastern wall of *Londinium* and positioned between two Roman roads. The southern of them followed the course of the current-day East Smithfield and The Highway. To the north was the Roman road that followed the course of St Clare Street and Hooper Street. Excavations at the latter revealed a

GLASS MANUFACTURE

ditch extending parallel to the road which is thought to represent the southern limit of the cemetery that was situated in the eastern 'hinterland' outside of the city walls.³

Roman pottery and a copper alloy bracelet were recovered from a sandy-gravel sequence of layers of made ground. Pottery dated from the 13th to 15th centuries and medieval glass was also found in this horizon. The medieval to late medieval material was present in minimal quantities and is thought to be intrusive within deposits largely reflective of Roman activity.

Agricultural land in the Saxon and medieval periods

There have been few finds of Saxon or early medieval origin in or around the site, suggesting that the local landscape was agricultural in nature. Excavations at 38–40 Dock Street in 2000 revealed ditches with pottery dated from 1240 to 1350 in their fills.⁴ The Abbey of St Mary Graces was established approximately 100m to the west in



Fig. 2: Salt Petre Bank, the predecessor to Dock Street on the Rocque map of 1746, with site outline

c. 1350, but its precinct is not thought to have extended across the site.⁵

A sequence of inter-cutting pits and ditches was observed cutting made-ground horizons, within which was pottery dated to the 15th century with some residual Roman material. Ground-raising followed, that in turn was cut by more pits, the fills of which not only contained pottery datable to the 13th to 15th centuries, but also a copper alloy toy wheel, an iron nail and an iron knife. Although they indicated occupation nearby, evidence of structural features was limited to a single posthole containing pottery dated to the 15th and 16th centuries. This was unique in suggesting a feature on the site dating from the transitional time between the medieval and post-medieval periods.⁶

The Great Fire

Dissolution of the Abbey of St Mary Graces in 1539 saw the grounds and buildings become a Victualling Yard for the storage of goods for the Navy.⁷ The absence of archaeological remains from the late medieval and Tudor periods across the site is likely to be a result of widespread quarrying following the Great Fire of 1666. Brickearth was required in significant quantities for the rebuilding of the city and, although not seen at this site, the extraction pits conveniently provided somewhere to dispose of the charred remains of damaged structures. Evidence for early-17th-century occupation of the site was seen in the remains of a red brick basement measuring 1.50m north–south and 2.55m east–west. An indurated clay-gravel floor surface filled the area, that had been truncated by a sizeable post-hole. Filling this feature was pottery dated to between 1580 and 1700, and a corroded possible copper-alloy coin. Two deposits filled the brick basement: a sandy mortar overlain by a silty sand. Both contained pottery and clay tobacco pipe from the 16th–17th centuries and ceramic building material from the 15th–17th and 12th–19th centuries. These dates suggest that the basement was backfilled towards the end of the 17th century. Two pits were also attributed to this period, both of which contained pottery dating from 1550 to 1700, as well as 17th–18th century glass and iron fittings.

Sealing these features was approximately 0.70m of purposefully dumped horizons that contained surprisingly few dateable artefacts. The top of this surface was heat-modified, suggesting that it had been exposed to industrial activity.

Glassmaking in the 17th century

Patents and licences were granted to foreign glass-makers, such as Jean Carré by 1567 and Jacob Verzelini by 1574, that encouraged the production of cheap goods and the transfer of skills to native Englishmen from a trade previously dominated by Venetian imports.⁸ This promoted the establishment of the industry by opening the market to a broader range of the gentry and middle classes as well as effectively bringing foreign imports to an end. The popularity of glass-making in the 17th century increased when it was favoured by the Stuart kings as a means of filling their pockets as well as enriching their favourites.⁹ At the same time, changes in furnace technology came about as a result of concerns over the depletion of the nation's forests in industries requiring high temperatures.¹⁰

In 1609, Sir Edward Zouche was granted a patent to use coal in glass-making, and as a result in 1615 the use of wood as a fuel in the furnaces came to an end. The different burning properties of coal led to changes in the physical layout of the furnaces, as is seen in the development of flues both for fanning the furnace and removing the ash produced by burning coal.¹¹ Zouche established a factory at Lambeth using the new coal-fired furnaces, which were continued following his death in 1634 by Sir Robert Mansell until his death in 1661. The further influx of skilled foreign glass-makers, such as the Venetian Rosetti around 1670, allowed the Vauxhall works to continue developing new expertise and speciality products such as looking-glass plates under the ownership of the Duke of Buckingham and operation of John Dawson. Nichols details the 'prodigious' profits of the joint venture;¹² this seems hardly surprising at a time when looking-glasses were previously sourced entirely from Venice.

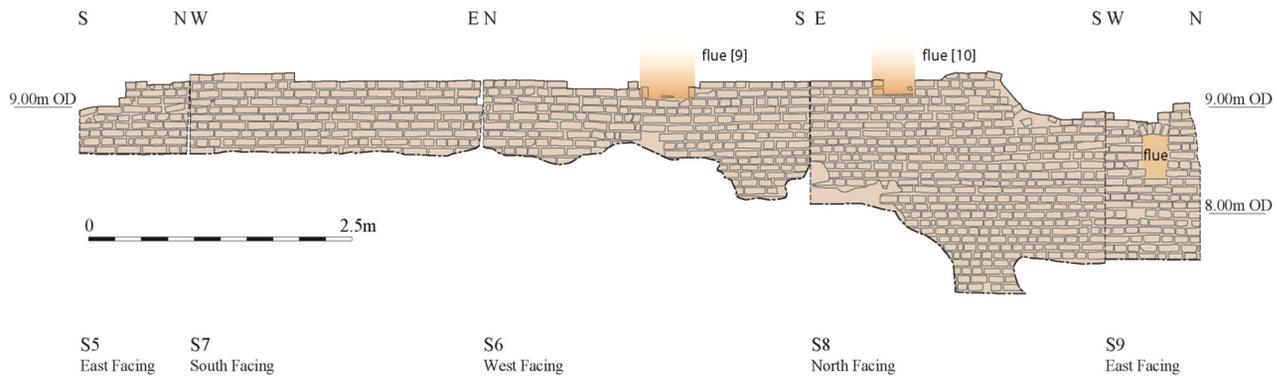


Fig. 3: elevation of wall of brick-lined feature in Flemish bond

Buckingham's lordly extravagance and colourful lifestyle meant that the cash was not always available to provide Dawson with the capital and security that was required to run the glassworks effectively. It has been suggested that this is what brought about Dawson's partnership with the financier John Bowles. With the considerable profits to be made from selling glass, manufacturers and retailers hatched a plan to regulate prices in the green glass trade. Along with John Bowles and Edmund Lewin, Edward Dallow was one of the three leading men of the manufacturing industry who met with the retailers represented by the Glass Sellers Company to enact the scheme. Of between only nine and eleven green glass manufacturers in London at this time, these three names represented the biggest works; the remainder are likely to have been copying them both in technological as well as pricing standards. It appears that the skills of the Venetian glass-makers had been adopted by a new era of manufacturers, which led to London becoming a leading centre of glass production.¹²

Dallow's Glasshouse

Bowles' ambitions extended beyond the production of green glass, as did those of the Dallow families. Salt Petre Bank, which was the name of Dock Street before the turn of the 19th century, was where the Dallow Glasshouse was situated (Fig. 2). It appears to have operated from before 1678 until 1730. Documentary sources state that the works were concerned exclusively with the production of green glass.¹³ Whether or not this included the patent that was granted to Phillip Dallow in 1689 to produce 'grenado shells of

glass' as Glass-Maker to His Majesty is uncertain. Several years of producing these primitive glass hand-grenades culminated in Dallow's summoning before a parliamentary committee to report on the subject of his glass duties in 1697.¹⁴

Contemporary glassworks around Rosemary Lane, the westward continuation of Cable Street towards the Minories and now Royal Mint Street, have been identified as belonging to Edmund Lewin, although they may have been additional Dallow glasshouses. It is uncertain whether Bowles' glassworks on the south bank of the river at Southwark or those at Ratcliff further to the east were involved in green glass manufacture. None of Bowles' surviving correspondence with the Glass Sellers Company mentions the Ratcliff site.¹⁵ Richard Neve comments on the quality of Ratcliff Crown Glass (a type of window glass, brought into the country by Henry Richards, following his work as a craftsman in France).¹⁶

The green glass trade involved the manufacture of bottles, drinking vessels, medical and domestic vessels of every description. Glass waste, predominantly comprising slag, cullet and other discard, which also contained several fragments of green glass bottles, was observed to fill a large square brick feature towards the north side of the excavations at Dock Street. This feature measured approximately 3.80m north-south by 3.20m east-west by 2.68m deep, and was built in a construction cut that penetrated through the heat-modified layer that sealed the phase of early post-medieval ground-raising. The base extended directly onto underlying gravels rather than a brick floor. On an approximate northwest to southeast alignment from the southern side of the

feature was a flue that was truncated towards its southern end. This was keyed into the main masonry of the feature. Similarly, a flue protruded from the eastern side and was truncated by a large pit. The bricks were consistently red and unfrogged with evidence of heat fracture to their inside faces. They were arranged in a crude form of Flemish bond (Fig. 3).

The east-facing section revealed a backfilled opening in the side of the brickwork just below the ground surface of the top of the feature. The top of this opening had a brick arch built into it and seems have represented a further flue (Fig. 3).

The primary fill had a dark sandy-silt matrix that was rich in charcoal and glass slag. This was overlain by a thick layer of crushed mortar that appeared to have entered from one of the flues. Demolition rubble sealed the sequence, again containing fragments of glass slag and cullet.

Most of the glass remains removed from the site were slag or gall, cullet and other waste. Cullet, drops, pulls and runs indicate that vessels, likely to have been wine bottles, were being produced in pale green, natural blue and colourless metal shades.

Unlike contemporary glasshouses that have been excavated at Hopton Street and John Baker's late-17th-century works at Vauxhall,¹⁷ evidence for the heating platforms or 'sieges' for the crucibles was missing at the Dock Street excavations (Figs. 3, 4). Iron grates seen in other furnaces,¹⁸ upon which fuel was placed, were also absent. The possibility remains that rather than representing the main furnace of the works, the feature was a component of another part of the glass-making process. Aside from the main

furnace, several other ovens were used. They included a 'fritting-oven', where ash and sand were heated together at a relatively low temperature, as was seen at Vauxhall. Historical sources¹⁹ suggest that they were usually structural additions to the main furnace rather than ovens in their own right.²⁰ Annealing furnaces are also common additions to main furnaces, and served to release the stresses in blown glass by reheating the object to a temperature where it would not melt again but where pressure would be released. It is also possible that the structure relates to a soda-processing oven, a further stage in the production of glass.

There was no evidence to suggest that the furnace was encased in a circular cone, as appears to have been common at other contemporary and later sites. It is possible that walls or foundations from a surrounding building existed beyond the limits of excavation, or that relevant wall elements were removed by later development of the site. The square nature of the furnace suggests that rather than being contained within a circular cone, a rectangular building such as seen at early drinking-glass manufactories may have been used, although until at least the mid-18th century, cone-type glasshouses were used specifically for the manufacture of glass bottles. The furnace in a cone-style structure was directly fired from a firebox in the middle of the building that was centralised with air supplied from underground tunnels or flues. There is certainly a similarity between this type of arrangement and the remains as seen at Dock Street (Fig. 4).

Crucible fragments recovered from the site are in a hard buff or light grey fabric, similar to those discovered at Vauxhall,²¹ and appear to come from similar-sized pots – i.e. approximately 550mm in diameter at the base. The fragments have a glassy surface on the interior – with some base fragments having a natural green glass adhering to them. The exteriors also have a vitrified surface, in some cases comprising a thick black layer (c. 2mm in thickness). Willmott calculates²² that such crucibles, with a reconstructed height of c. 600mm, could have contained enough glass to make 300 early wine bottles or 1000 stemmed goblets. The

crucibles' elements found were very fragmentary, suggesting the vessels had been purposefully broken up.

It should be noted that no distorted or waste vessel fragments were recorded. Neither were there any moils – waste fragments from the ends of blowing irons. That these two types are missing from the assemblage is not necessarily unusual – the crucibles and pot metal would be waste from the furnace itself whereas wasters and moils, as part of the production process, might have been gathered together separately for recycling.

The backfill of the brick feature, as well as historical records, suggests that green glass bottles and phials were being made at the site.

The Dallow family's operation of the Salt Petre Bank Glasshouse ended in 1730 when Phillip Dallow (Junior) and Phillip Dallow (Senior) sold the works to Maltis Ryall Esq. who is more likely to have been a speculator than a glass-maker. This period of the glassworks saw expansion in the range of products, with the works no longer being concerned solely with the manufacture of green glass but also the making of flint, crown/sash and looking glass.²³

Ryall presumably still owned the works in 1746 when Rocque's map was published. Salt Petre Bank is clearly shown as a north–south aligned road that extends between Cable Street and Ratcliff Highway. To the east of the street is an open area marked as 'Glass House Hill'. It is uncertain whether this relates to a naturally occurring topographical feature or whether it was a product of the works. In addition to this, several structures are visible on the eastern side of the road, although there is no indication of any circular-shaped building that may have related to the conical chimney of a furnace. There is also no suggestion of any discrete rectangular building in the position of the excavated feature.

In 1757 the works are known to have passed into the sole ownership of Richard Russell. Together with William Riccards, he obtained a patent for a new glass furnace technology in 1760.²⁴ It is not thought that any of the works at Salt Petre Bank were rebuilt to adopt this new technology. The last known owners listed in *The Directories* are Russell, Slater & M. Horne from

between the years 1793 and 1800. Although not immediately apparent from written sources, a Horwood map dated to 1819 suggests that the works had ceased operations, with a large rectangular building seen on the south-eastern side of the street in the same location as number 15 Dock Street. Terraces seen to the north of the site and two other larger structures constituted the street frontage. The partial demolition of the glassworks structures and the subsequent construction of the 19th-century buildings appears to have removed most of the glassworks layout. Construction of a residential property here in 1873 would also have had a destructive effect on what may have remained of the glasshouse buildings.

Conclusions

The location of the site between two roads leading east from *Londinium* explains the presence of Roman archaeology towards the base of the sequence. It is not immediately obvious whether the sandy gravels observed represent natural stratigraphy or redeposited material from this period. Saxon and medieval finds are relatively sparse and reflect the site's position in an agricultural landscape at that time.

The importance of the site is linked to its relationship with the developing glass industry of the 17th century. The size and arrangement of the brick structure seen in the archaeological works can be compared to the historical, cartographic and written sources that detail the Salt Petre Bank Glasshouse at this location. Whilst the Dallow family who came to run the Salt Petre Bank Glasshouse entered into an agreement concerning manufacturing green glass with other manufacturers and retailers, they, like others, appeared to broaden their horizons by involvement in subsidiary glass-making schemes. The sale of the works to Maltis Ryall broadened the range of glass products being made at the site, although these were not reflected in the remains uncovered. The glassworks continued under the control of Richard Russell, who along with a partner was successful in obtaining a grant for new furnace technologies,²⁵ although again none of these remains were identified in this excavations.

The square brick furnace is the most recent surviving archaeological remains on the site, these having been truncated by development of the land into terraced housing and warehousing at the start of the 19th century. Indeed, all traces of the previous industry are absent from a map dated to 1819. Further damage is likely to have been done to the underlying glasswork remains in the building of the current structure on the site in 1873.

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Richard Humphrey acquired a BSc and an MSc in forensic archaeology at Bournemouth University. He started with Pre-Construct Archaeology in 2005 where, other than spells of excavation in Afghanistan and the Lebanon, he has worked on complex

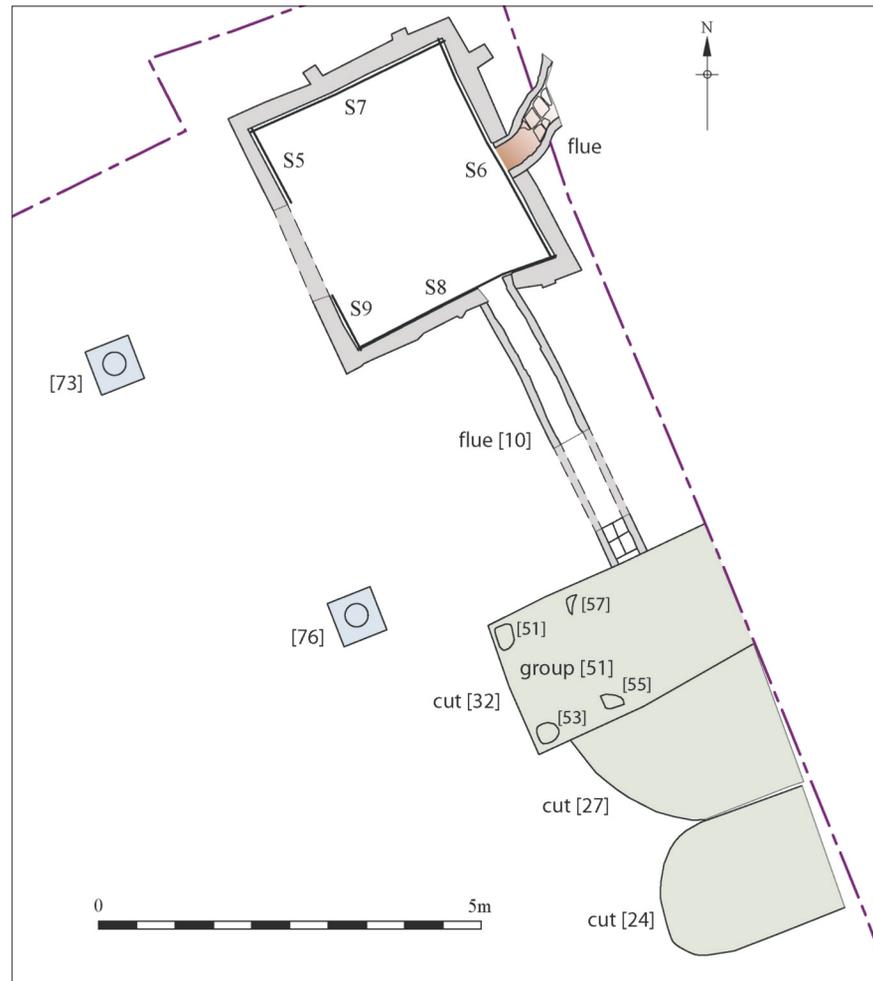


Fig. 4: Dock Street furnace and flues

excavations of the former Royal Clarence Naval dockyard at Gosport as well as on numerous Roman and multi-period sites in London. John Shepherd got his degree at the Institute of Archaeology in London, specialised in Roman glass, and is the author of a range of archaeological

books, for example on the work of W.F. (Peter) Grimes and the Roman Fort at Cripplegate, as well as a range of academic articles. He was the manager of the LAARC at the Museum of London and is currently active as an independent archaeologist and researcher based in London.

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