ST PAUL'S CATHEDRAL: EVIDENCE FOR A SAXON DITCH AND MEDIEVAL ACTIVITY FROM EXCAVATIONS AT PATERNOSTER SQUARE 2000–2001

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With contributions by Lyn Blackmore, Nigel Cameron, Jane Corcoran, Anne Davis, Geoff Egan, Jacqueline Pearce, Natasha Powers, Kevin Reilly, Mary Ruddy, Robert Scaife and John Shepherd

SUMMARY

Excavations carried out during the redevelopment of Paternoster Square in 2000 and 2001 revealed multi-period archaeological remains. This article outlines discoveries dating from the Saxon and medieval periods. A large man-made watercourse or ditch running southwards to the west of St Paul's Cathedral was excavated and radiocarbon dates confirm that it was in use during the 7th–8th centuries and perhaps was associated with the founding of St Paul's in AD 604, while the associated pollen showed evidence of cereal cultivation and arable or waste land. This ditch was backfilled during the early 12th century as part of the Bishop of London's rebuilding scheme. Burials of 8th- to 10th-century date were found to the north of the cathedral. The earliest Saxon ceramics recovered from the rubbish pits found scattered across site were residual sherds of Middle Saxon Ipswich ware. Finds from the various early and late medieval rubbish pits provided evidence of diet and daily life. One pit, which was backfilled in c.1500, contained an assemblage of high status glassware, probably associated with the bishop's palace. An isolated medieval masonry footing may be part of the Vicars Choral complex. Part of the City's medieval water-supply system was also discovered; it consisted of a section of lead pipe over 7m long, representing a portion of the conduit which ran from Paddington to Cheapside and provided drinking water between the 13th and 16th centuries.

INTRODUCTION

During 2000 and 2001 Museum of London Archaeology (MOLA) (prior to 2009 known as the Museum of London Archaeology Service) undertook several excavations during the redevelopment of Paternoster Square; a large area of land directly to the north of St Paul's Cathedral (Fig 1; Table 1). The works were commissioned by Stanhope and Mitsubishi Estate (Sites B and D), Standard Life Investments (Site A), and HSBC (Site C). The four main excavations took place during 2000 and 2001, although they were all preceded by extensive phases of evaluation, watching-brief and geotechnical monitoring (full details are in Watson 2006, 6). All four excavation areas yielded extensive archaeological remains dating from the Roman period through to the present day. The Roman and post-medieval results have been published elsewhere (Watson 2006; Watson & Pearce 2010). Pottery fabric code expansions are available from http://www.museumoflondon.org.uk/Collections-Research/LAARC/ (accessed 2012).

Table 1. Details of excavations undertaken on the Paternoster Square Masterplan site

Site prefix	Site code	Site name	National Grid Reference
A	SLY00	Juxon House	531950 181200
B	NGT00	Newgate Triangle	531985 181250
C	PNS01	Paternoster Row	532065 181235
D	PSU99	Stonemason's Yard Ramp	531920 181210

PREVIOUS EVIDENCE FOR THE 'WESTERN STREAM'

Paternoster Square is located at the highest point in the City of London. The modern topography of the area is fairly level at *c.*17.00m OD, with the ground falling away steeply to the River Fleet at the west and the Thames to the south. The underlying geology is Eocene London Clay, overlain by Pleistocene terrace gravels. Geoarchaeological contour plots of the site show a slope within the gravels from north-east to south-west with a large linear hollow in the London Clay running in the same direction, confirming that natural drainage on the site is in this south-westerly direction (Fig 2). This depression in the London Clay dates from the period when the Thames was carving out a new floodplain, across which the Taplow Gravels were subsequently deposited, around 128,000–280,000 years ago. This would have remained as a shallow depression in the surface, even after infilling

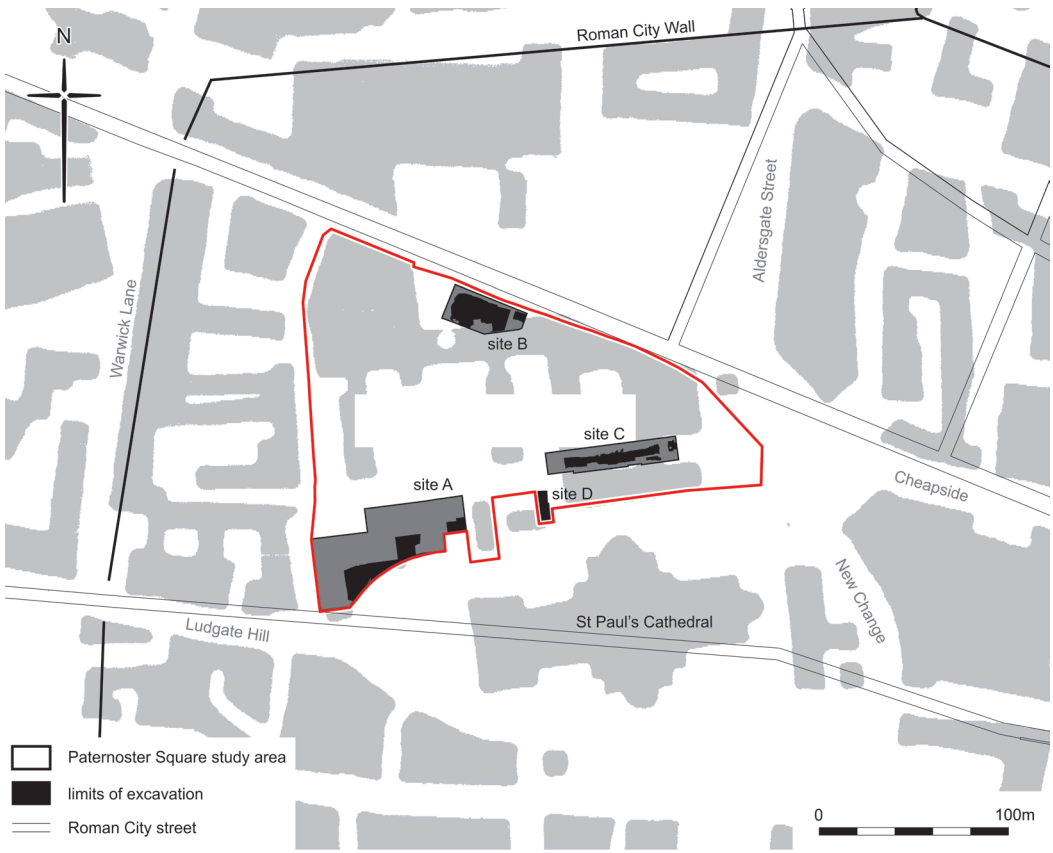


Fig 1. Site locations (scale 1:4000)

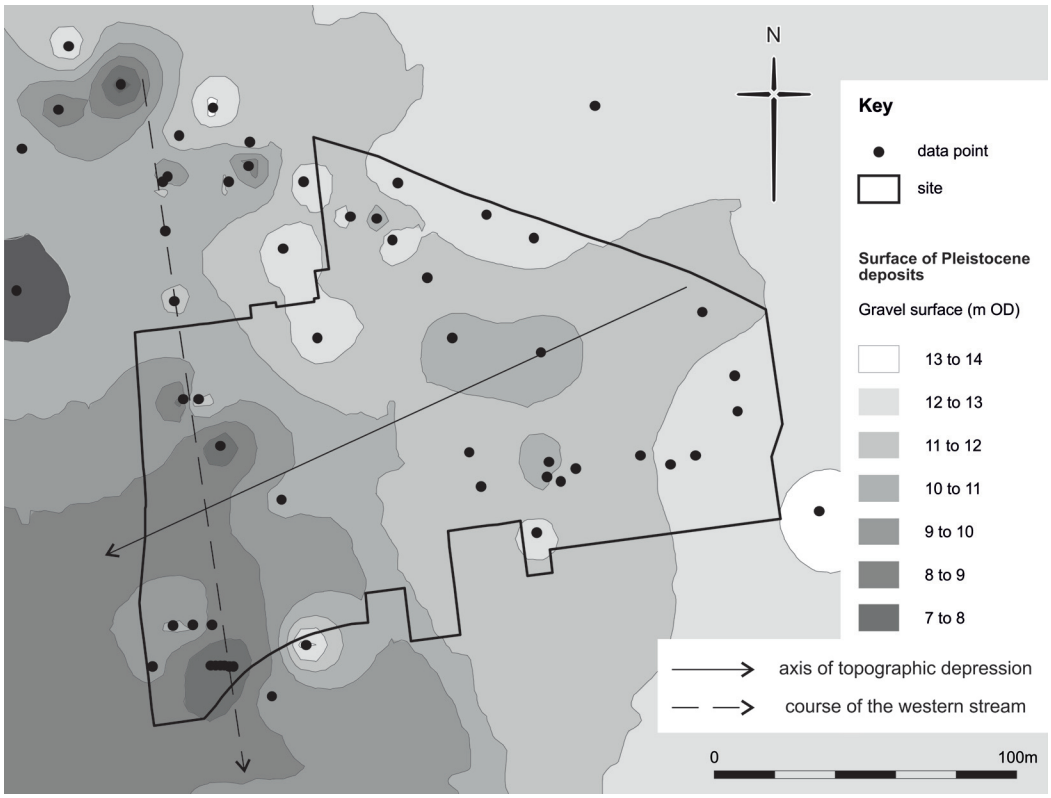


Fig 2. Contour plot of surface of terrace gravels (scale 1:2500)

by the gravels and the later brickearth had masked its alignment, reflecting the point at which groundwater emerged from the interface of the Hackney and Taplow Gravels, fanning out towards the Fleet to the west (Watson 2006, 9–10).

A major topographical influence on the landuse of the area was a large stream channel running in a southerly direction to the west of the modern churchyard, known as the 'western stream'. Initially observed by Peter Marsden during the 1961–2 development of the site, profiles through the channel were drawn and Roman pottery recovered from its basal fills (Bentley 1987, 330; Merrifield 1965, 192). Marsden concluded it was a natural stream flowing in a deep valley, utilised by the Romans to provide water for a pottery industry in the area (kilns were found on Paternoster Square). Later work in the area by Brian Pye revealed that the channel had been recut several times and the upper fills were the result of deliberate backfilling, possibly during the 11th–12th centuries (Bentley 1987, 331). It was thought that this channel continued to the south-west, to join the Thames south of modern Queen Victoria Street (Tyler 2000, 23). The channel was likely to have still been visible during the 13th century, as it formed the boundary between the Farringdon Within and Castle Baynard Wards. Bentley concluded by suggesting that the channel was a 'vast man-made feature' (1987, 334). Recent work on other sites in the vicinity (Askew 2007; Lyon 2007; Pitt 2006) and on Paternoster Square (Watson 2006, 10, figs 9 & 12) has concluded that this feature was not naturally formed; although it may have partly utilised the natural depression formed by the linear hollow in the London Clay (Fig 2), the watercourse cannot have been part of this particular channel, as it ran perpendicular to the depression (Watson 2006, 12). In conclusion, this stretch of the 'western stream' is now interpreted as a

large man-made feature, which could more aptly be described as a ditch than a stream channel. The northern portion of this feature might have served as a water supply for the cathedral area, while the southern end of it certainly had both a drainage and a rubbish disposal function.

Other stream channels which are probably of natural origin were recorded on various sites to the north running in a westerly direction towards the V-shaped Fleet valley; these channels were recut during the Roman period (Pitt 2006, 48; Askew 2007, 259). The date for the initial cutting of the watercourse on Site A had remained unclear, although it was previously thought that this channel was cut to divert the course of streams to the north and was backfilled during the Roman period, possibly after the construction of the city wall in *c.*AD 200 (Shepherd 1988, 19).

SAXON ACTIVITY (*c.*AD 600–900)

Environmental reconstruction of a large watercourse to the west of St Paul's

Jane Corcoran, with plant remains by Anne Davis, pollen analysis by Rob Scaife and diatom analysis by Nigel Cameron

The upper portion of a large truncated north–south-aligned watercourse was excavated in plan on Site A (Fig 3). However, due to depth restrictions, the lower portion of this large feature could only be investigated in two geoarchaeological auger transects (Figs 2–3). The southernmost transect has been used to reconstruct a profile across the feature, which was formerly known as the 'western stream' (see above) (Fig 4).

Geoarchaeological investigation has revealed that this watercourse was about 20m wide and in profile had a flattened 'U'-shape — the eastern edge presenting a concave slope, with an overall gradient of 45 degrees, but shallower at the top and steeper towards the base (Corcoran 2002). The base of the feature was around 8m wide and relatively flat but not level, being slightly deeper to the west (6.35m OD–6.70m OD). The 'cut' for the channel feature was identified by the transition from fine-grained (low energy waterlain) deposits to gravel, but more significantly by a black manganese-stained band overlying an orange, iron-concreted horizon at the top of the gravel. Chalk clasts were found at the base of the fine-grained channel fills at the western end of the transect (AH 1). These were not well-rounded, as would be expected if they had been transported by water or had lain for any time on the bed of a channel. Nor were they weathered, as would be expected if the base of the feature had been 'dry' and a soil or plant growth developed across it. They are likely to have been discarded or have fallen into the channel feature from the adjacent bank or have been deposited during its construction. Either way they are likely to date the base of the sequence to the historic period, probably late Roman onwards. This was confirmed by the pollen assemblages from the overlying fills, which are clearly of historic age and are typical of those found in urban environments where admixtures of pollen occur through extremely complex taphonomy (Scaife 2002). There is a general absence of arboreal pollen from the channel fills and the presence of a single grain of walnut (*Juglans regia*), which is generally regarded as a Roman introduction into Western Europe as a whole (Godwin 1975), suggests a Roman or post-Roman date.

The augerhole sequence suggests that the lowest fills of the channel feature were deposited by natural processes. A sequence, *c.*1m thick, of inter-bedded humic muds and sands was found at the base of the feature in the western part of the transect; this is likely to represent low-energy water flow and the build-up of a channel bar. A radiocarbon date of CAL AD 650–780 (Beta-192219) obtained from organic sediment within these deposits indicates that they accumulated during either the 7th or 8th century (see Appendix 2 for details). The diatoms present in the channel bar deposits were characteristic of shallow water habitats with high flow rates, although they indicated that some 'backwater' areas would have existed for algae and aquatic plants to become established. It is therefore likely that the floor of the channel feature was traversed by a shallow, fairly swift flowing watercourse, with vegetated bars and still water areas on either side of the main channel.

The decay of plants colonising the surface of the channel bar created a peaty deposit,

Fig 3. Conjectured line of channel on Site A, also showing the auger transect used in Fig 4 (scale 1:400)

*c.*0.40m thick, lying between 7.60m and 8.20m OD and lensing-out towards the east. Radiocarbon dating shows that the accumulation of the peat deposit had begun to take place in augerhole 1 by CAL AD 650–950 (Beta-165048) and in augerhole 2 it was still accumulating by CAL AD 1020–1210 (Beta-192217) (Fig 4). Sand lenses within the peat indicate that the bar was probably subject to periodic submergence, implying that water

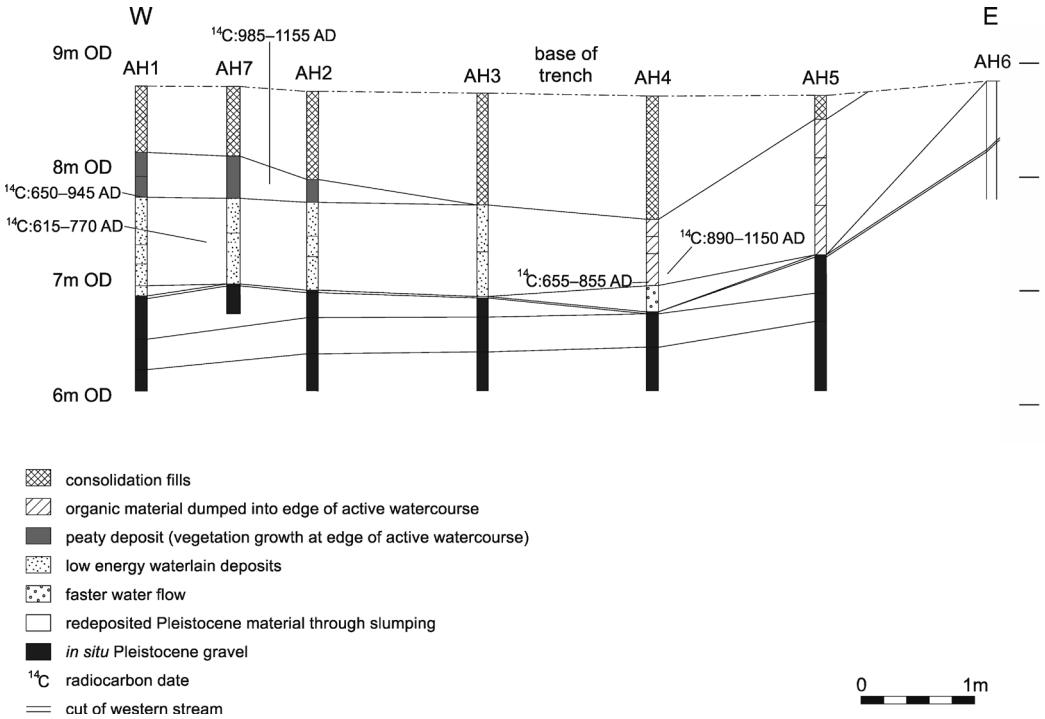


Fig 4. Reconstructed profile across the channel on Site A, based on geotechnical augerholes (AH1–7) (scale 1:150)

was still flowing through the feature as it accumulated. However, the diatom assemblage indicates that the surface of the bar was likely to have dried out regularly. The diatoms also indicate relatively high nutrient levels, suggesting the influx of domestic waste into the channel feature, or fairly intensive human and animal activity on the adjacent land (Cameron 2002). The pollen evidence also hinted at domestic refuse being dumped into the watercourse. The main water flow appears to have been close to the eastern bank, where a sandy gravel deposit suggestive of faster water flow and containing brick and tile fragments, was found at the base of the sequence. The flowing water on this side of the feature probably undercut the banks and may have caused slumping. Diatoms indicated fairly fast, but shallow water flow and periods of lower water levels. Brackish diatom species were suggestive of some contact with the tidal Thames.

In contrast to the natural build-up of peaty deposits on the western side of the channel, organic refuse appears to have been dumped into its eastern side, perhaps indicating a greater level of activity along this bank of the watercourse. Radiocarbon dates of CAL AD 670–870 (Beta 192218) and CAL AD 890–1150 (Beta 165049) towards the base of these organic sediments suggest refuse was thrown in (and was probably carried away by the flowing water) over a period of several centuries, from the 7th century onwards. Botanical samples taken from the eastern side of the channel indicate that there was cultivation taking place in the vicinity (Davis 2002); the samples included fruits of wild radish and seeds of stinking mayweed and corn cockle, while remains of cornflower and corn marigold were also quite widespread. These may well be associated with the frequent, and often abundant, finds of cereal straw and rachis fragments, suggesting the regular dumping of used straw in the channel. The majority of the disturbed-ground plants represented in the samples have more catholic habitat requirements, and include plants such as fat hen, knotgrass and small nettle, which may grow in a variety of waste-

ground habitats as well as on cultivated ground. Some of the most abundant seeds came from plants of waste and rough ground which has been enriched by manure or other decomposing organic material. Henbane, hemlock, stinging nettle and elder were all frequent finds, and indicate that this type of refuse was present either in or around the ditch. Some evidence was also found of grassland plants, with seeds of buttercups and wild grasses in almost all samples (Davis 2002).

With this data it is now possible both to date the establishment of the watercourse and to reconstruct its environment. There is no evidence for this channel having been of Roman origin; on Site A it truncated early Roman features and contained redeposited Roman finds of mixed date, as it did on other sites (Bentley 1987, 331; Tyler 2000, 31). The radiocarbon dates indicate it was open and flowing in the early to mid-7th century at the earliest. These dates all imply that the ditch was in use during the 7th–8th centuries, which means that its construction may be related to the first St Paul's, traditionally founded in the vicinity of the later cathedral in AD 604 (Taylor 2004, 5). Interestingly, the pollen evidence from the basal fills shows that the channel was not running through an abandoned area or such high amounts of pollen from cereals and weeds of cultivation would not have been present in the Saxon deposits.

Having established that this watercourse was contemporary with the Saxon cathedral, then its geographical context must be considered. After the founding of St Paul's the political and religious situation remained insecure and there is little firm evidence to definitively locate the cathedral buildings or confirm events (Taylor 2004, 7). However, by the early 8th century a charter of St Paul's had referred to *Paulesbyri*, suggesting the cathedral occupied an enclosure, and although this could perhaps have meant the entire walled Roman city (Vince 1990, 81), it could feasibly be referring to an area separated by a ditch feature, such as the watercourse found on Site A. The function of the feature during this period may not have been purely defensive: Schofield (2011, 44) refers to the importance of baptism in the Church at this period and hints at the possibility of the watercourses in the area having provided a venue for outdoor ceremonies of this nature. Obviously the more prosaic uses of water for domestic and/or small-scale industrial purposes should also be considered. If the water originated in springs along the gravel terracing, it would have been drinkable at points to the north of Site A.

Archaeological evidence of Early and Middle Saxon activity

There is a dearth of evidence of Early and Middle Saxon (*c.*AD 410–850) activity from the modern City of London; this is assumed to be due to the fact that the focus for Middle Saxon (*c.*AD 650–850) settlement was to the west at *Lundenwic* (Malcolm & Bowsher 2003, 2). However recent excavations have confirmed that there was some occupation during the 5th and 6th centuries at St Martin-in-the-Fields church within *Lundenwic* (Blackmore 2010; Telfer 2010; Telfer in prep). The documentary reports of the foundation of St Paul's in AD 604 have not been corroborated archaeologically, largely due to extensive later Saxon and medieval phases of rebuilding and terracing of the area (Vince 1990, 10), as well as the major groundworks by Wren after the Great Fire and subsequent modern developments (Schofield 2004, 124–5; Schofield 2011). Inside the walled Roman city evidence of Early and Middle Saxon activity is generally restricted to residual finds within later contexts, so the nature of this period of occupation remains enigmatic. However, the consensus is that there was some form of predominantly ecclesiastical settlement to the south of St Paul's during the Middle Saxon period with the later mercantile centre located at *Lundenwic* to the west. A recent synthesis detailing the Saxon finds from the St Paul's area indicates the presence of several areas of activity in the area to the south and west of the present cathedral (Blackmore 2011; Schofield *et al* 2009; Schofield 2011, 51–3). Two of the sites concerned are located immediately to the south of St Paul's, at 29–33 Knightrider Street (TAV82) and at St Peter's Hill/223–225 Upper Thames Street (PET81), where small amounts of chaff-tempered ware and a few imported wares were found. Closer to

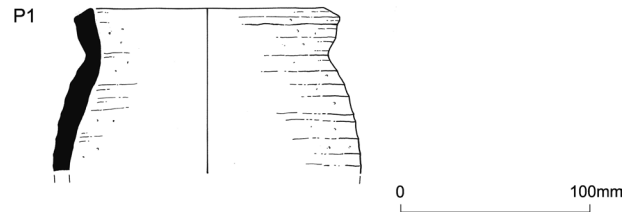


Fig 5. Rim of an Ipswich medium ware (IPSM) cooking pot <P1> (scale 1:4)

the Thames are two sites at Baynard's Castle and Mermaid Theatre, both near the Saxon shoreline along Thames Street, where a few sherds of chaff-tempered ware and Ipswich ware were found (Rhodes 1980, 97–8).

In *Lundenwic*, Ipswich ware became the dominant type of pottery by *c.*AD 750 and appears to have remained so well into the 9th century (Blackmore 2003, 234). Introduced *c.*AD 730, this successful product was widely distributed from Suffolk (East Anglia) around the coast, into the Thames estuary and upstream from London, possibly as part of the activities of Frisian traders. Most finds outside East Anglia are from emporia, ecclesiastical and 'high status' sites. One definite and two possible sherds were found on Site A; all residual in pits which cut earlier Roman activity rather than Saxon features or deposits (see Fig 14). The first is part of the rim of an Ipswich medium ware (IPSM) cooking pot (<P1>, Fig 5; diameter 140mm; see also Schofield *et al* 2009, fig 6 and Schofield 2011, 52, fig 3.22). The other sherds, from a larger cooking pot, are from a channel backfill. The thickened everted rim form is typical of Ipswich wares, while the fabric, although less definite, is close to that of the medium fabric range; unusually, however, it contains small fragments of burnt bone (Blackmore 2010).

SAXO-NORMAN ACTIVITY (*c.*1050–1150)

The backfilling of the watercourse on Site A

With plant remains by Anne Davis and animal bones by Kevin Reilly

It appears that the channel remained open throughout the Middle and Late Saxon periods (*c.*AD 850–1066). Peaty deposits with sandy lenses indicative of episodic water flow were dated to AD 685–1155 in AH 2 and intermittently flowing water is also implied by lenses of silt and sand within the roughly contemporary organic backfills in AH 4. These are the latest dates obtained, however, from the channel deposits, prior to the deposition of about 0.60–1.0m of clayey gravel deposits which were recorded in the upper part of the auger sequence (between 7.80m OD and 8.80m OD). These deposits are consolidation fills, representing large-scale backfilling of the feature. They are more organic above the eastern part of the feature (AH 3 and 4, see Fig 4), suggesting that this area may have remained wetter, even after backfilling. Bulk samples from this phase of backfilling were analysed and were generally very similar, giving a good idea of conditions along the banks of the feature and nearby.

Seeds of club-rush and spike-rush, which grow in or beside shallow water, were found in most samples. Other plants of wet soils or seasonally flooded ground were more common and included celery-leaved crowfoot, tripartite bur-marigold and golden dock, which are characteristic plants of muddy banks (Ellenberg 1988). Marsh marigold and ragged robin also grow on banks, but in slightly less wet soils so may have grown further up the banks. Remains of aquatic invertebrates were rare, although occasional water-flea eggs were seen in several samples and in one sample a number of aquatic molluscs were found. These were all identified as common bithynia and common valve snail, both of which can be found in slow-moving bodies of water in rivers, canals and ditches (Alan Pipe pers comm). The botanical and molluscan evidence suggests, therefore, that this feature contained slow-moving, shallow water for at least part of the

year, and would have had marshy areas and muddy banks.

The upper fills were interleaving layers of organic material, including layers of straw, and more sterile layers of gravelly clay — presumably added to prevent or reduce the smell from the rotting organic vegetation. Within these were seeds of henbane, hemlock, stinging nettle and elder, which would have grown in nitrogenous soils enriched by the dumping and decomposition of manure or other organic materials. Several of the wetland plants found, including celery-leaved crowfoot and golden dock, are also found in nitrogen-rich soils, suggesting that this dumping may have taken place in the channel itself and on drier areas on the banks, perhaps creating noxious conditions in the area. However it does not seem that these conditions prevailed in all areas, and the aquatic molluscs found do not suggest a high level of pollution. There is some botanical evidence for grassy places, and possibly for trees and shrubs on the banks of the channel.

Remains of food plants formed only a very small part of the plant assemblages from the channel fills, suggesting that kitchen waste and human faecal matter were only minor components of the dumped material. Some evidence for faeces was found in the form of cereal bran, most of which was from wheat or rye, although some oat bran was also noted in one of the samples. Occasional fruit stones and pips were also present, and included one or two seeds of fig, grape and plum/bullace. Other fills of this feature contained abundant blackberry/raspberry pips, which may have come from the local vegetation rather than from domestic waste, and occasional remains of sloe, crab apple, hazelnut and wild strawberry, whose origin could also be either natural or in dumped material.

Frequent and often abundant finds of cereal straw and rachis fragments, as well as seeds of arable weeds, suggest regular dumping of cereal products in many fills of the channel. These may have been waste products resulting from cereal processing, possibly taking place nearby, or could have come from dumped straw used for animal bedding or other purposes. Occasional flax and hemp seeds would have come from plants grown, perhaps locally, for the production of textile fibres, and for the use of their seeds as food or for oil. The quantities involved are small, and thus do not suggest that production or processing of these crops took place in the immediate vicinity, although similar remains have been found in channel or ditch fills at the nearby sites of King Edwards Buildings (Davis 2007) and Newgate Street (NEG98) (Davis 2006). Flax stems had to be 'retted' in water before the seed capsules were removed by combing (Baines 1985, 133), and the channel may have provided a suitable environment for this activity.

The animal bone assemblage from the watercourse fills provides some evidence of the diet of the local inhabitants, with most of the bones deriving from the major mammalian domesticates. One of the upper dumps provided a larger than average collection of cattle head parts, perhaps suggestive of a dump of butchers' waste. The other food species included a collection of game, with a significant number of mammal and bird species. There were two horse bones, a pelvis and a sacrum, both probably from the same small adult animal, either a small pony or a donkey. Horse was accompanied by a few dog and cat bones, as well as a selection of incidental species, including red kite, raven and black rat. All were undoubtedly scavengers within this area. Notably, red kite has been identified at several medieval sites in the City (Mulkeen & O'Connor 1997, 444). This bird was in fact present in considerable numbers in London up to the early post-medieval period (Sharrock 1976, 112; Fitter 1990, 51), where it enjoyed a protected status.

A possible date for the backfilling of this watercourse is provided by a writ of Henry I, probably of 1111, which announced his grant to St Paul's and the bishop, Richard, of so much of the 'ditch of the royal castle near the Thames' (*ie* the first Baynards Castle) as would be needed to build a wall and a road outside it (Schofield 2011, 162). On Wardrobe Place to the south-west pottery indicates that the channel was backfilled between the late 11th and early 13th centuries, with Tyler (2000, 36) concluding it was backfilled in *c.*1114. Botanical remains from this site concur with Site A, that the backfilling did not contain a

large percentage of food remains, rather that it was predominantly refuse and dumped deposits.

Pottery from the backfilled watercourse

Lyn Blackmore

The date suggested above is supported by the large amount of pottery recovered from the upper backfills of the channel on Site A, which comprises at least 537 sherds from up to 343 vessels; the range of ware types is varied, but homogeneous, and generally typical of the first half of the 12th century. Pottery that is definitely of pre-Conquest date is limited to five sherds of Late Saxon shelly ware (LSS). Other wares that could have been used either before or after the Conquest are also limited, with only eleven sherds of early medieval sand-tempered ware (EMS) and nine of early medieval shell-tempered ware (EMSS; 1000–1150). Finds include a flaring rim with thumb impressions around the inner edge (*cf* Vince & Jenner 1991, fig 2.39, no. 81) and a strap handle. Handles in EMSS are rare and generally associated with large bowls; this example, however, has a broad base and must be from a pitcher in the LSS tradition (*cf ibid*, fig 2.25). Early medieval sand-and-shell-tempered ware (EMSH) is slightly more common (17 sherds), while the most common fabric is early Surrey ware (ESUR) with 187 sherds; both were in use between 1050 and 1150. There are also ten sherds of the related early medieval iron-rich ware (EMIS). Again, cooking pots are the most common form, 23 of which have thumbed rims, while one sherd has incised wavy line decoration. The only other fabric type of this period is early medieval grog-tempered ware (EMGR), the 17 sherds of which include a complete spout from a pitcher.

The second most common fabric is London-area greyware (LOGR), with 181 sherds, some large, mostly from layers making up a single channel fill (166 sherds). Forms other than cooking pots include sherds from two cresset/hanging lamps (Vince & Jenner 1991, 34, fig 2.26, nos 36–41, fig 2.41, nos 92–4; Egan 1998, 130–1; Pearce 1998, 127–8, fig 98) and two/three spouted pitchers, two of which have rouletted decoration. Horizontal bands of rouletting are also present on a heavily sooted bowl. Shelly-sandy ware (SSW; *c.*1140–1220), by contrast, is limited to four sherds from two vessels. Coarse London type-ware (LCOAR; *c.*1080–1200) and the calcareous variant (LCOAR CALC) are more common, with 53 sherds. Most are from cooking pots but five are from jugs or pitchers of some form, with a clear glaze that in some cases has reduced to give a greenish colour; they include part of a strap handle with an applied thumbed strip down the back (*cf* Pearce *et al* 1985, fig 17.25) and a pitcher decorated with notched rouletting around the rim and on the body under a reduced greenish glaze. A few sherds identified as LCOAR could be Winchester-type ware (see below) or *vice versa*. The only piece of London-type ware (LOND) would appear to be the leg from an aquamanile or part of a chafing dish which is in a slightly sandier fabric than usual (<P2>, Fig 6). Of composite construction, it comprises a long piece with flat back and slightly arched central projection along the front (*ie* a T-shaped section) with notched rouletting along each edge; one end is hidden by part of an applied pad of round section, which in turn has a square projection to help

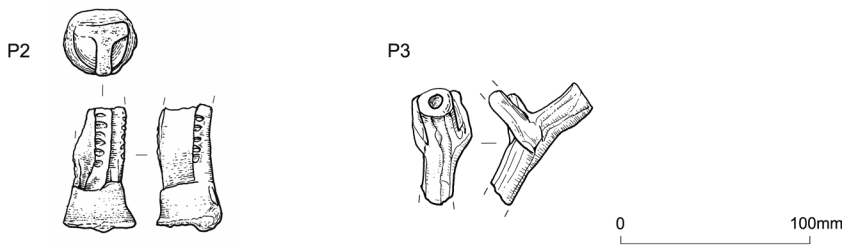


Fig 6. Leg from an aquamanile in London-type ware (LOND) <P2> and a Stamford ware (STAM) tubular spout with supporting strut <P3> (scale 1:4)

key it into another component of the object. No exact parallels are known for this find. Aquamaniles would be rare finds in the 12th century, but chafing dishes are known from both London (Pearce *et al* 1985, 44, 132, fig 73.400) and Bergen (Blackmore & Vince 1994, 66–7, fig 27.172).

Non-local wares from the channel backfills comprise an important cluster of Winchester ware (WINC), and sherds from two vessels in Stamford ware (STAM). One of the latter is a complete knife-trimmed tubular spout with supporting strut (<P3>, Fig 6), very like an example from the Guildhall (GDH85; Vince & Jenner 1991, fig 2.101.240), but with a twisted applied strip along the centre of the strut. The other sherds are from a thick-walled pitcher with glaze all over the underside of the base.

Winchester-type ware (WINC) is locally dated to between *c.*AD 950 and 1110, while the later tripod pitcher ware dates from *c.*1066–1150/1200 (Winchester fabric codes MWW and MAD respectively; Hurst 1962a, 188; Hurst 1964, 124; Biddle & Barclay 1974, 138–41; Collis 1978, 257; McCarthy & Brooks 1988, 189–2; Blackmore 2008; Holmes & Matthews in prep). Tripod pitcher ware is handmade and noticeably coarser than the earlier ware, with a gritty texture (Hurst 1962b, 190). In some cases it can be difficult to distinguish between WINC and some London-type wares. The present finds belong to the later group, with up to fifteen sherds from eight or nine pitchers, of which eight are from a single fill. They include three sherds from a tripod pitcher with greenish glaze all over the underside of the base (slightly worn on the surviving foot). Four sherds are from the rim and shoulder of a pitcher with flaring neck and the scar of a deep spout rising from just above the junction with the neck. The latter is marked by an applied horizontal cordon, below which is at least one vertical thumbed strip; the glaze is greenish in colour. Another neck sherd could be from this or a similar pitcher. The overall form is very similar to that of pitchers found in 1961 at Winchester cathedral (Biddle & Quirk 1962, 190–2, fig 10), on the George Hotel site (Cunliffe 1964, fig 28.1), in the Easton water main trench (Collis 1978, fig 111.17), and in Southampton (Platt & Coleman-Smith 1975, fig 137.41). Some of these also have horizontal bands of notched rouletting, a feature present on two other pitchers from Site A. Another form of decoration comprises applied paired slashes (length *c.*10mm) around the top of a thickened/beaded rim (for profile *cf* Biddle & Quirk 1962, fig 10). Two sherds from a jug/pitcher in a fine fabric with horizontal rows of slight finger impressions under a patchy clear glaze are problematic as they could be a Winchester-type fabric or calcareous London-type ware (LCALC).

Finally there are 16 sherds from 12 imported vessels, of which 11 are of Andenne ware; the others comprise two sherds of North French glazed ware (NFRE), one of Normandy glazed ware (NORM), one of possible Normandy gritty ware (NORG), and one of red-painted ware.

When the pottery assemblage is considered as a whole, the predominance of ESUR (*c.*1050–1150) and LOGR (*c.*1080–1200), the relative frequency of coarse London-type wares but near absence of shelly sandy ware (SSW), which appeared *c.*1140, and London-type ware, which came into common use around the same time, a date between *c.*1100–1150 might be suggested for the backfilling of this feature. The cluster of Winchester ware is an intriguing feature, perhaps hinting at contacts between the two bishoprics. The impression from the range of frequency of the different wares is that although there was some activity in the area before 1050, the population increased in the mid- to late 11th century, generating the rubbish that was disposed of in the former channel and reclaiming the land for development, presumably at the same time as areas away from the waterfront and to the north of Cheapside began to be occupied and built up (Schofield *et al* 1990; Howe & Lakin 2004; Pitt 2006).

The cemetery on Site A

Natasha Powers

Four heavily truncated supine inhumation burials were discovered on Site A (Fig 7), and six contexts of disarticulated human bone were recovered from later pits. Contextual data indicated that some of the disarticulated material had originated from the four burials, all of which were within grave cuts aligned east–west. None had

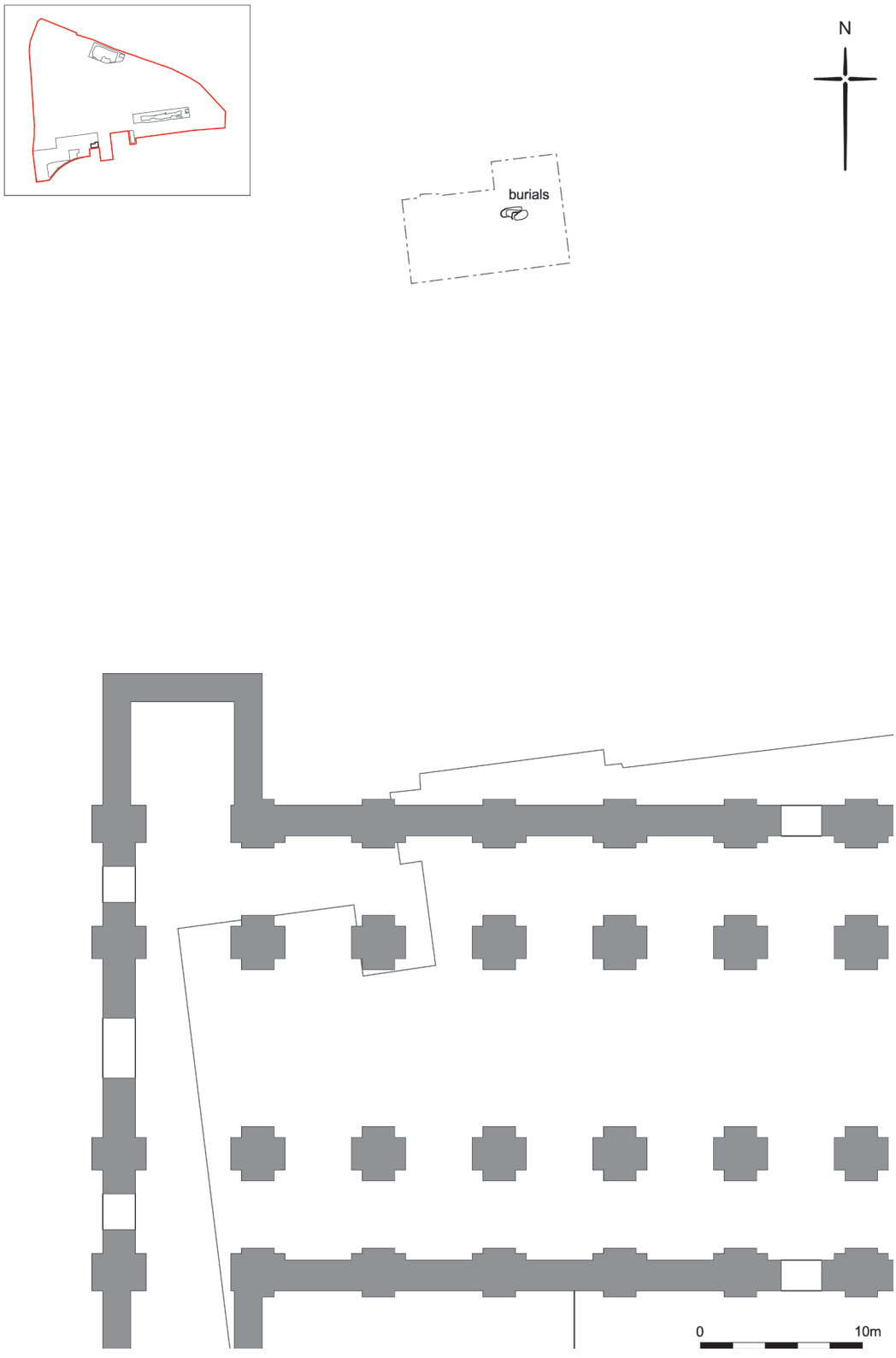


Fig 7 . Location of burials from Site A in relation to the 12th-century cathedral (after fig 4.48 in Schofield 2011) (scale 1:800)

evidence of coffins or coffin furniture. Using the maximum number of repeated elements, there was a minimum of one adult individual from each of the articulated burials. In order to provide a more accurate estimate, the disarticulated remains were catalogued and the total number of each element or part thereof combined, to give a total of eight adults and two juveniles. The articulated burials consisted of the remains of four adults: two individuals aged 18–25 years at death, one aged 36–45 years at death, and one 'adult'. It was only possible to estimate the sex of two skeletons, both probable males (using Buikstra & Ubelaker 1994). The general robusticity of the skeletal elements and measurements of the length of the glenoid cavity (Dwight 1894 cited in Bass 1987) suggested that the remaining two individuals were also probably male, though caution should be practised given the small amount of both individuals available for analysis. Truncation prevented the determination of stature for all of the individuals. Unfortunately there were insufficient data from a sample of this size to draw any conclusions on health, demography or status.

An attempt to precisely date the skeletal remains by radiocarbon dating was unsuccessful due to their poor condition. The pottery found associated with one of burials amounted to only three sherds of EMSH dating to 1050–1150; this has the potential to be intrusive given that all the burials were truncated by pitting also dated to 1050–1150. Burials excavated about 50m to the south-east have been dated by Carbon 14 to the late 8th–10th centuries (Schofield 2011, 46–7). Stratigraphic and level data can support the suggestion that the Site A examples could in fact be contemporary with these, rather than date to the later 11th–12th centuries, although this remains uncertain. Notably, the burials fall within the area of the extended 12th-century precinct and therefore may have been interred after this later date (J Schofield pers comm). Either way, relatively little skeletal material from the 10th–12th centuries has been excavated in the City of London, notable exceptions being the relatively small groups from St Lawrence Jewry (GYE92) (Bowsher *et al* 2007, 23) and St Nicholas Shambles (GPO75) (Schofield 1997, 109–10). The east–west orientation of these remains would be consistent with an interpretation that they represent Christian burials (Gilchrist & Sloane 2005, 152). Given their relatively early date it would seem likely that they were associated with the initial use of St Paul's Churchyard and as such their location can shed light on the early cemetery boundaries. The precise extent of any cemetery from this period is unknown, although the area has been reconstructed as largely open in the 11th and early 12th centuries (Schofield 2011, 162, fig 4.109), until the time when the cathedral was rebuilt and the channel backfilled. The area utilised for these burials had been encompassed within the precinct walls by *c.*1200 after the surrounding houses and streets were acquired by the bishop (Keene 2004, 20). However, in the absence of any documentary evidence for a cemetery here, it has been suggested that these burials pre-date the Vicars Choral complex (discussed later) (Schofield 2005, 101).

Saxo-Norman refuse pitting across Sites A–D

The early medieval period in the areas to the north of the cathedral precinct is largely characterised by open area activity on all the Paternoster Square sites. In the north of the development area on Site B several pits were ranged across the site (Fig 8), backfilled with domestic refuse and predominantly locally produced pottery. Some of these pits directly truncated the Roman road running east–west across the northern edge of the site (Watson 2006, 20), suggesting that the medieval road had already migrated slightly to the north towards its modern line. There were no linings visible in these pits, possibly due to the unfavourable preservation conditions. Their fills generally dated to the latter half of the 11th century; they provided a large quantity of animal bones comprising a relatively wide array of species. Notably, one of the pit fills provided a deposit that appeared to represent butchers' waste, with 52 out of the 61 sheep bones being head and foot parts. This shows the presence of local butchers, apparently specialising in sheep butchery, and possibly originated from the butchers' establishments at the nearby meat-

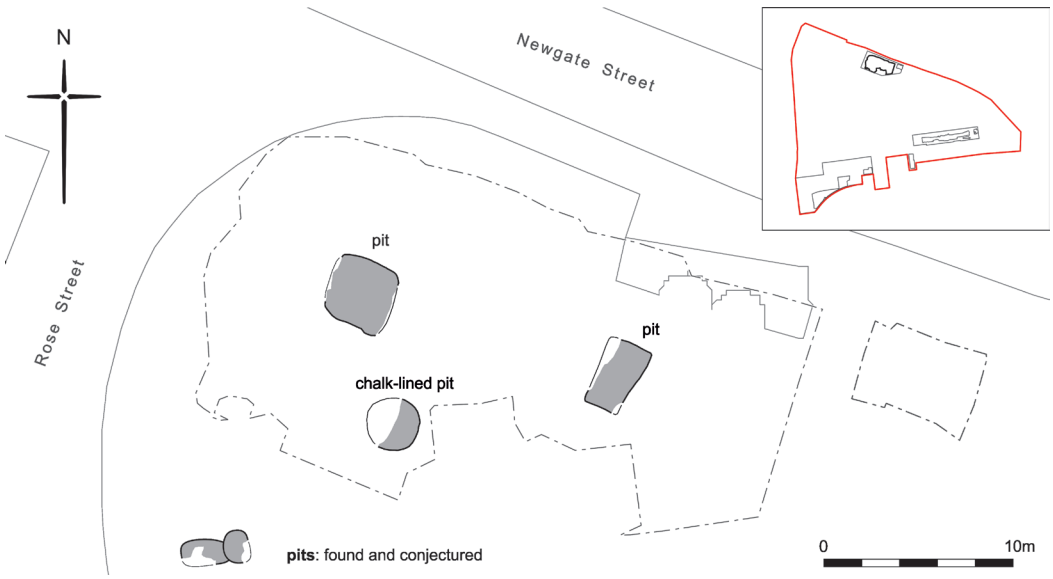


Fig 8. Plan of early medieval refuse pits on Site B (scale 1:400)

market of St Nicholas Shambles, which was established before 1187 (Ainsley 2004, 105; Dyson 1997, 78), or perhaps from the large kitchens at the cathedral itself. The age of the major domesticates, as suggested by the epiphysis fusion data, was fairly uniform. The great majority of the cattle and sheep/goat were relatively old when culled, suggesting the importance of ante-mortem products, most probably dairy and wool. In contrast, most of the pigs represented are second-year animals, demonstrating their major use as meat providers. The relative absence of older individuals may be indicative of the absence of local breeding, which is also suggested by the lack of very young animals, although a small number of infant lambs were recovered. It is possible that these were culled locally, in relation to the provision of fresh milk. Both cows and ewes were frequently leased to medieval households for just this purpose (Hammond 1993, 41).

There was also a relative abundance of domestic birds (chickens) and fish (eel and herring), supplemented by a variety of game species. The game species include a number of clearly high status meats: deer (red and roe), crane and peacock. The crane was amongst a small number of species particularly prized as game by falconers, an exclusively high status pastime, while the strong tasting peacock was a particular favourite at feasts. A noteworthy use of this bird was the 'pecockes in his haskell and trapper' where the head, tail and skin were refitted to the cooked carcass to make a spectacular centrepiece (*ibid*, 137–8). The non-edible portion of these assemblages includes a collection of dog and cat bones, these largely derived from complete skeletons of juveniles within the same single pit fill. This deposit also provided a partial skeleton of an adult raven.

The species composition within the animal bone assemblage may provide some clues as to the status of the nearby households, with particular reference to the nearby St Paul's precinct, and it is notable that deposits within both the Site B pits and the backfilling of the channel provided a range of high status comestibles. It would appear that the channel (adjacent to the precinct) provided a greater range and quantity of such species in comparison to the pitting on Site B. While this difference may be significant, the proportion of waste from high status foods remains small, perhaps suggesting a minor usage of such meats on special occasions, or the mixed state of these waste deposits arising from various households and/or city amenities. Of particular interest, however,

is the abundance of sheep/goat amongst the Paternoster Square sites, in marked contrast to other early medieval sites in the City and other southern English medieval towns, where cattle is inevitably the dominant food species (Grant 1988, 152). The single London exception were the 12th/13th-century deposits extracted from 25 Cannon Street which coincidentally is also adjacent to St Paul's precinct. It is tempting to suggest that this greater use of mutton may be related to a particular dietary preference within this part of the City, perhaps related to the ecclesiastical community within the precinct. However, there is no comparable evidence from the excavated religious establishments located around the City and it is more likely that these assemblages either relate to secular houses ranged along medieval Newgate Street or to the meat-market in The Shambles. The bone assemblages from 11th-century Westminster Abbey, 11th/12th-century St Mary Spital and 13th-century St John Clerkenwell are all dominated by cattle bones (Pipe 1995, 119, 232; Sidell & Fitzgerald 2004, 383).

Elsewhere two bone skates were recovered from one of these pits (<502>; <503>; Fig 9) (West 1982; Egan 1998, 294–5). They were not a matching pair although the discovery of two skates together is unusual. One was extensively worn through use (<503>), the other not worn at all (<502>). They would presumably have been used in marshy areas such as Moorgate, where extensive areas of open water would have facilitated this winter pastime. It remains open to question whether it would ever have been practical to use them on the Thames.

Pottery from the Saxo-Norman pits

Lyn Blackmore

It is likely that all these pits on Site B are of 11–12th-century date, as 86 of the 125 sherds are typical early medieval wares similar to those from Site A (described above); most identifiable forms are bowls and cooking pots. Of note is part of a large pot with deep collared rim in early medieval shell-tempered ware (EMSS); this form is part of a continental tradition that was emulated in Canterbury by

Fig 9. Bone skates from an 11th- to 12th-century pit on Site B (<502> and <503>)

immigrant potters (Cotter 1997) but is rare in London at this date. The 19 sherds of coarse London-type ware (LCOAR/LCOAR CALC) are mainly unglazed and from cooking pots, one with a typical Saxo-Norman profile and thumbed rim, but one everted jug rim with incised wavy line decoration under a clear glaze was also found; there is no parallel for this form in the corpus of London-type wares (Pearce *et al* 1985). As on Site A, glazed London-type ware (LOND) is rare (three or four sherds). Imported wares, however, differ in that there are only single sherds of Winchester ware (WINC) and Andenne ware, but seven sherds from five jars and pitchers in Thetford ware (THET), two of which have applied thumbed strips. A near complete rounded crucible and fragments from another were found in one of the pits.

The 33 sherds from Site A comprise a fairly limited range of wares similar to those from the ditch, and the different groups could all date to the late 11th century. Of note is part of a dish in early medieval sand-tempered ware (EMS) (Vince & Jenner 1991, fig 2.34.60). Unusually for the period, the dish appears to have a self slip over the inner surface and to have been wiped.

Only 22 sherds of medieval pottery were found on Site C; most are of late Saxon or early medieval wares, but two cooking pots are in shelly-sandy ware (SSW), the latest of the shell-tempered wares and part of the London-type ware industry (Blackmore & Pearce 2010). Of these one is of particular interest as the short upright neck with crudely finished bead rim and slack shoulder (<P4>, Fig 10) are typically early medieval in style (Vince & Jenner 1991, figs 2.38.67 & 2.28.69), suggesting that the pot is an early product of the new industry; there is no exact match for the form in the recent corpus (*ibid*, fig 20).

LATER MEDIEVAL ACTIVITY (*c.*1150–1500)

London's population quadrupled between 1100 and 1300, and much of the City's street pattern was established before 1150 (Thomas 2002, 63). Many of the new buildings were now constructed in stone and this is taken as an indicator of the growing wealth of the population. The area to the north and west of St Paul's Cathedral became a focus for religious communities during the later medieval period, although little is known (or mapped) of the contemporary street pattern within the Paternoster Square area.

Pitting along Newgate Street

With finds by the late Geoff Egan and ceramics by Jacqueline Pearce

The pitting seen on Site B from this period is located towards the south end of that site, presumably to the rear of properties fronting onto Newgate Street. These pits (Fig 11) all contained general domestic refuse material, with the easternmost pit fill [2086] containing some potentially high status items. These included high status tablewares, such as a blue glass beaker with red, yellow and white enamel decoration on its outer surface, thought to date from the 13th–14th centuries but deriving from a Byzantine tradition of blue glass (John Shepherd pers comm). A fragmented group of pots largely comprising Surrey-Hampshire coarse border ware (CBW: Pearce & Vince

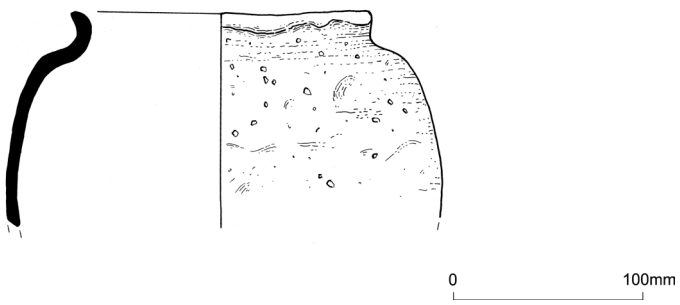


Fig 10. Shelly-sandy ware (SSW) cooking pot <P4> (scale 1:4)

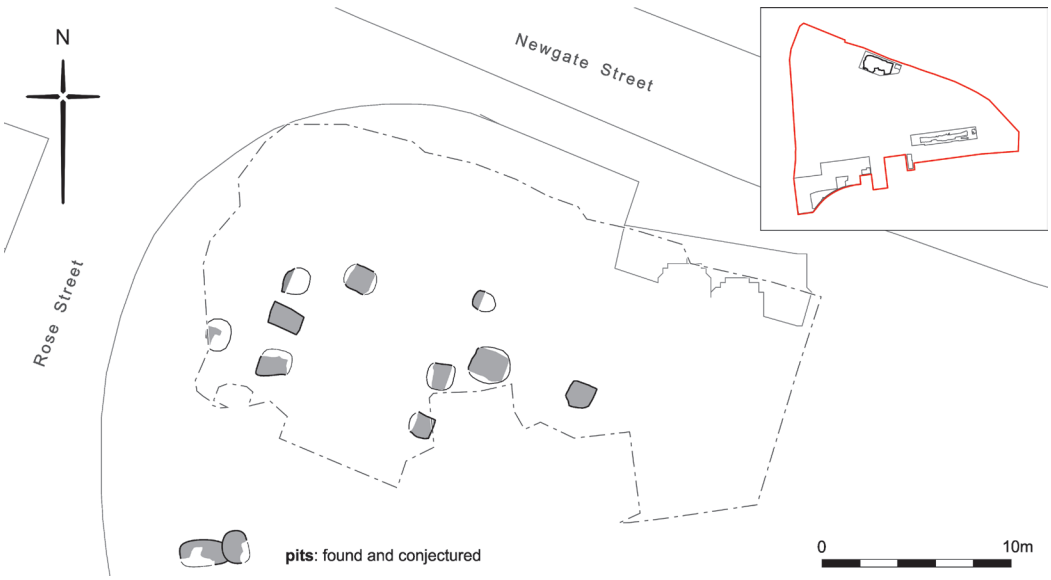


Fig 11. Plan of later medieval pitting on Site B (scale 1:400)

1988) demonstrates the main forms in everyday use: jugs of various types, including large bunghole jugs or cisterns, cooking pots and pipkins, or small handled cooking vessels. Other sources of supply include a Surrey whiteware fabric (CHEA: *ibid*) represented by part of a small dish. Examples of two imported pots were also found in the same pit group: sherds from two jugs made in the Saintonge, in south-west France, one green-glazed (SAIG) and the other with painted polychrome decoration (SAIP). The French wares were certainly among the most decorative and attractive pottery available at the time, and entered London as a by-product of the trade in wine from Gascony through Bordeaux.

A large group of late 13th-century pottery (47 vessels identified from 167 sherds) was recovered from the infill [3066] of the westernmost pit (Fig 11; Jeffries 2002). It includes a comparable range of fabrics and forms, with sherds from at least 25 jugs retrieved in a variable condition, all but two of them in London-type ware (Pearce *et al* 1985). Although many are relatively plain, at least 15 of these are decorated and are of types that would have been in contemporary use. Most are decorated in the Rouen (*ibid*, 28–9: up to seven baluster jugs) and North French styles (*ibid*, 29: three similar vessels) that may have been introduced into the London potteries at the end of the 12th century, under direct influence from the Continent by French potters settling in the capital. There are also five examples of the more florid and elaborate, highly decorated style (*ibid*, 29–30) that evolved out of the early French copies in the middle of the 13th century, with all manner of applied decoration, stamps and rouletting and the use of different coloured slips and glazes. In addition to London-type ware, there are sherds from a highly decorated jug in Kingston-type ware (Pearce & Vince 1988), a fine whiteware fabric first used in London *c.*1240, and from a jug in South Hertfordshire-type greyware (Blackmore & Pearce 2010). If all the jugs thrown away in the pit came from the same household or institution, they most likely represent a relatively well-off establishment in which large-scale entertainments and feasts were customary, although preservation is generally poor, suggesting material redeposited from middens.

Another group of similar date came from the infilling ([1355]) of a chalk-lined cesspit (Fig 11), and includes a smashed rounded jug in coarse border ware (Pearce & Vince 1988:

broken into 35 sherds) and a large part of a bunghole jug, as well as sherds from cooking pots. There are also sherds from two jugs in Kingston-type ware (KING), one of them a plain baluster form (*ibid*: 22 sherds) and the other the base of a metal copy baluster jug (*ibid*), a relatively uncommon form typical of the late 13th century. This cesspit was in use for a long period between the 13th and 16th centuries. It had been recut and a chalk-lined drain was added during the 16th century (not illus). The chalk blocks used in the construction were very cleanly hewn; the shaft appeared to have belonged to a relatively high status household, with the lower fills containing bones from birds such as peacock and juvenile chickens. The close proximity to St Paul's and the associated religious and secular dwellings that were situated around the precinct may be the source for these remains from high status meals.

Pitting adjacent to the cathedral

With finds by the late Geoff Egan and ceramics by Jacqueline Pearce

Two 13th-century cesspits were excavated on Site D (Fig 1; Fig 17), both of which were timber-lined and extended to a contemporary medieval depth of *c.*4m below ground level. One had a lining that appeared originally to have been constructed from a combination of wattle and planks, although it was extremely degraded. Of more complete survival was the unusual find of a turned wooden bowl (Fig 12, D<18>), a thin-walled vessel with prominent turning grooves all over, apart from the base and on the slight, flat foot, which is covered and surrounded on part of the immediately contiguous outer wall with cut marks in all directions (as if it had been used inverted as a carving board, perhaps for herbs — the pressure usually exerted for cutting bread or vegetables or even some fruit would probably have damaged this delicate vessel); the lower shaft is darkened from greasy contents. Also within the pit was a bone flute (Fig 13, D<52>) made from the left tibia of a fallow deer (identification by Alan Pipe) and adapted as a fairly crude fipple flute with a single hole at the mouth end (the other end is broken off but the relatively small portion missing suggests there were never any finger holes to allow more than very limited variation in notes). It has some polish from use and was probably a simple leisure instrument rather than for

Fig 12. Late medieval turned wooden bowl <18> from Site D (diameter 147mm)

more sophisticated use such as at religious services.

A moderate quantity of animal bones was recovered from these two pits, including the bones from a few thrushes. It can be suggested that the local meat diet on this part of the study area was largely dependent on beef with the other species providing a relatively minor part of the meat demand. This is in contrast to the pitting along medieval Newgate Street (Site B), where there was an abundance of sheep/goat. There are, notably, no obvious high status foods, and apart from two bones from first-year lambs and two possible veal cuts, no clear representation of choice cuts of meat. It could be supposed that the proximity of these waste dumps to the cathedral might have been shown by the inclusion of various high status foods or choice cuts. However, the evidence suggests that the major part of these dumps were probably from low to modest status domestic establishments, perhaps canon's houses (John Schofield pers comm). Botanical samples revealed further information concerning diet, with a rich assemblage of food remains, including many fig pips, cherry stones and apple pips, as well as remains of grape, mulberry, plum, fennel and black mustard.

Both these pits also contained disarticulated human bone from a minimum of two adults, one male and one probable female 26–35 years old. The bones may represent the disturbance of Roman or later burials; late Roman burials were excavated on Site C and the area was utilised for burial during the late Saxon and medieval periods.

The pottery from these cesspits provides a good example of the kinds of fabrics and

Fig 13. Bone flute <52> from Site D (length 189mm)

forms commonly used in London in the mid-13th century (*c.*1240–70), with locally made London-type wares and South Hertfordshire-type greywares dominating. A pottery industry using the local London clays to make wheelthrown and usually glazed wares, London-type ware (Pearce *et al* 1985), appears to have started production towards the end of the 11th century and rapidly became one of the most prolific providers of ceramics used by Londoners until the 14th century. Jugs were the principal form made throughout this period, often reaching great heights of decorative exuberance in the 13th century, as also demonstrated on Site D. The filling of one pit ([52] and [53]) included sherds from a number of baluster jugs decorated in styles inspired by late 12th- to early 13th-century North French models, with green glaze over white slip and applied clay strips, sometimes rouletted. One of these North French decorated jugs has survived almost complete. Part of a London-type ware spouted jug, decorated with combed patterns and applied, rouletted strips, with an overall white slip and green glaze, represents a less common find. Applied spouts were not as common as pinched pouring lips made on the rim, and were often associated with anthropomorphic and zoomorphic vessels, which were especially popular in the 13th century and have much in common with the eccentric menagerie that often inhabited the margins of medieval illuminated manuscripts. Rather more unusual is part of a fine whiteware jug, green-glazed inside and out, and imported from northern France. The vessel is probably of pear-shaped form and has rows of individually applied pellets of clay covering the body, a style that was quickly imitated by the London potters, although their original models are relatively rare finds in the capital.

While London-type wares generally catered for the more presentable tableware component of Londoners' household equipment, the kitchen and storage pottery tended to be much more plain and practical, with the strong and robust, wheel-thrown greywares made at various centres along the borders of south Hertfordshire and north Middlesex providing a range of cooking pots and jars and ordinary, serviceable jugs (Blackmore & Pearce 2010). They reached the height of their popularity in the mid- to late 13th century and were ideally suited for everyday utilitarian functions by their very hard, non-porous fabric. At Paternoster, they are among the more common finds in 13th-century contexts. These pits relate to the period during which the precinct of the cathedral was enclosed by a wall, with gates leading to the streets beyond. Schofield (2011, 166, fig 4.112) has the pits located to the east of the Hall of Minor Canons on the north side of the Pardon Cloister, within the complex of buildings associated with the minor canons. The minor canons had a relatively substantial income although they lived and ate communally (Davis 2004, 159), and it is certainly possible that these assemblages relate to their dining hall.

The Vicars Choral complex

On Site A, a masonry footing was excavated, cutting into the backfills of the channel at the far south-western corner of the site (Fig 17). It survived to a depth of 1.10m and was constructed of two builds, the lower of which was random uncoursed chalk rubble, 0.48m deep, bonded with a loose sandy lime mortar. The upper part of the footing was more mixed; of random coursed chalk and Kentish ragstone rubble, with occasional brick and sandstone, bonded with a very hard pale grey sandy mortar. On stylistic grounds the lower part of the foundation is of medieval date and the upper is probably of early post-medieval date. The contemporary ground surface was truncated and there were no contemporary features with which to relate this footing, although the fact that it was isolated may suggest one side of a gateway or a pier from a large building. The fragmentary nature of this structure does not allow firm conclusions regarding its original function, although it falls within the site of the Vicars Choral complex dating to the 13th century (Schofield 2005, 101). The vicars choral were employed to sing the liturgy during services at the cathedral. The complex is known to have included a dining hall in 1273, and in later periods references are made to a house, buttery, kitchen, shop, chambers, garden yard and a well (*ibid*, 102). Currently it is not possible to relate this single foundation to any particular building, given the equally fragmentary archaeological

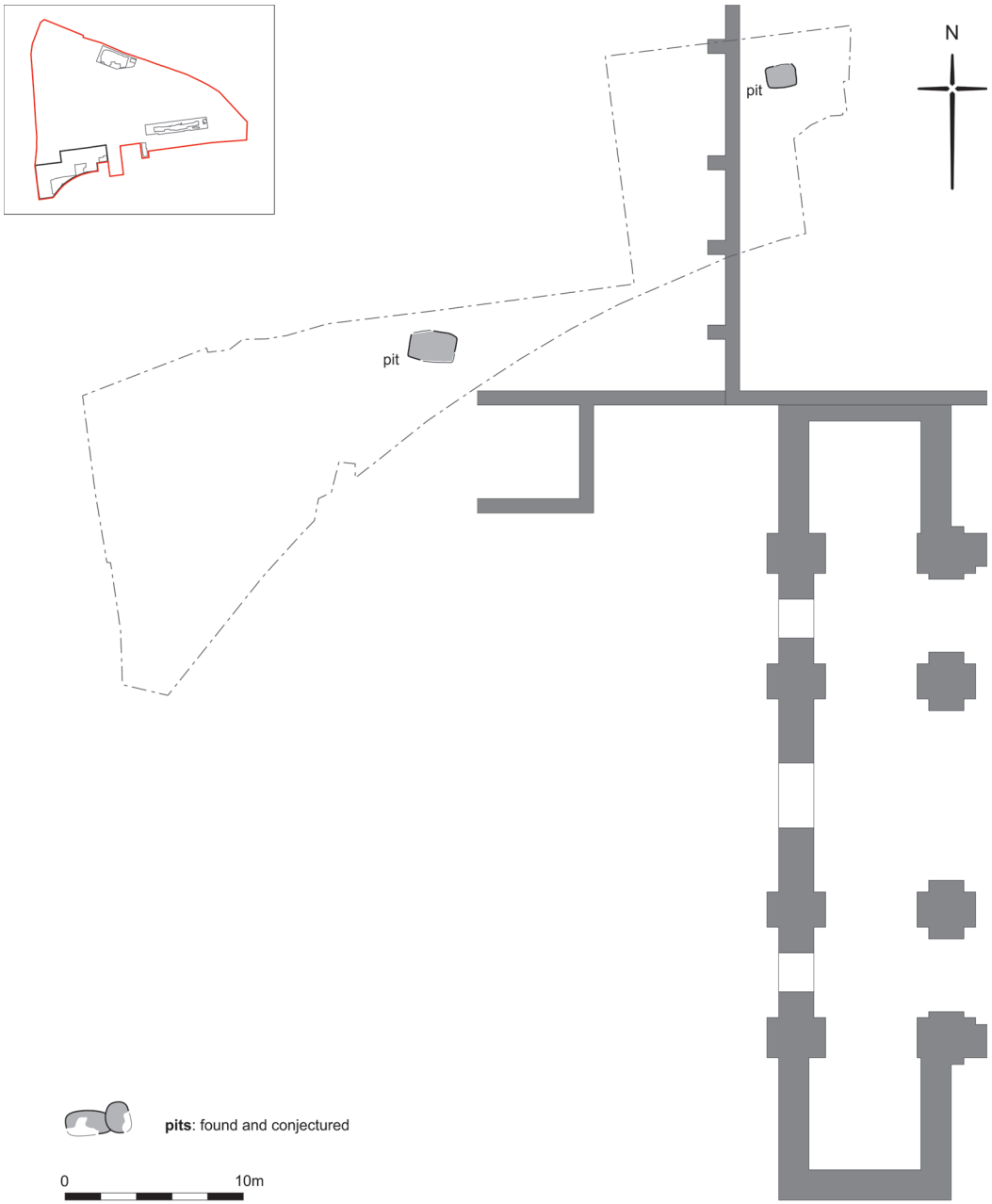


Fig 14. Plan of medieval refuse pits on Site A (scale 1:400)

and documentary sources of evidence. However, there is not known to have been an alternative building in this area of the site, so it can be postulated that the footing relates in some way to the series of buildings of the Vicars Choral.

Glass assemblage from pits on Site A

On Site A two unlined rubbish pits, dated to *c.*1500, were probably situated within the yard of the palace of the Bishop of London (Fig 14). These pits mainly contained dom-

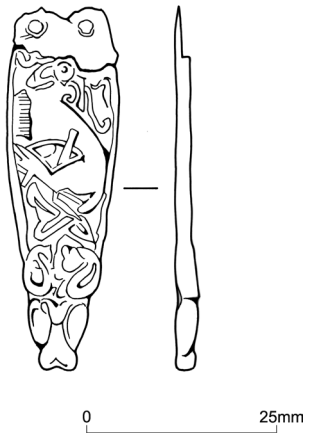


Fig 15. Copper-alloy strapend <87> from Site C (scale 1:1)

estic waste material, animal bone remnants and other refuse, although within one pit fill was a copper-alloy strapend with interlace decoration of an animal in relief and surviving traces of gilding, dated *c.*1000–1200 (Fig 15, <87>). Also within these pits was one of the most extensive glass assemblages to have been recovered from medieval London (Fig 16: <2>, <1>, <35>, <36>, <103>, <104>, <105>); see Appendix 1 for glass catalogue and full report. This small assemblage is remarkable for the mix of fine quality glassware from diverse continental sources and local products dating to the 15th to 16th centuries. There is little doubt that this assemblage is high status; the presence of the imports emphasises this. It needs to be recalled also that, in the late medieval period, even locally produced glass was used mainly by the upper echelons of society. The presence of imports from Italy, Germany and the Argonne region suggests the highest level of society. Similar mixed assemblages, containing a collection of imports and locally manufactured glass, are few in London. Two City of London assemblages are pertinent here. The Post Office Court, 1–3 Abchurch Lane assemblage (GM1), found in 1939, came from a cellar; a dump of material over fire debris contained green-glazed pottery of the 14th and 15th centuries, as well as imported and local glass, including two flasks similar to Nos 5–8. More recently mixed assemblages such as this from Site A were found on the Plantation Place, Fenchurch Street site (FER97; Tyson in prep).

In this context, associated with the cathedral site, it is highly likely that this assemblage was tableware used by the highest orders of the clergy and their guests, possibly even from the household of the Bishop of London. However, the reasons for their discard cannot be determined.

Chalk foundations on Site A

A large construction trench excavated at the eastern end of Site A may relate to the Bishop of London's Palace complex which was constructed in this location sometime during the 13th century (Schofield 2011, 324) (Fig 17). The width of the trench varied between 1.05 and 0.69m and survived up to 0.80m deep. Where the trench encountered Roman pits, these were dug out, and filled with masonry. The trench was filled with a wall footing of roughly coursed chalk and Kentish ragstone rubble, bonded with a pale yellow sandy mortar with pea grit inclusions. The part of this foundation that runs north–south at the south-east of the area was built entirely of ragstone rubble, and may have been a later build. The footings are positioned to the eastern side of the palace complex, within the gardens. This area is shown on plans to have been open, although the bishop's chapel was located here at the south-east (Schofield 2011, 164). Antiquarian observations indicated the walls were constructed using Kentish ragstone rubble (*ibid*, 165), and the possible rebuild observed in 2001 may be contemporary.

WATER SUPPLY IN MEDIEVAL LONDON

On Site C a significant discovery dating to the medieval period was a lead water pipe, running east–west and encased in clay at the base of a trench located to the south of the line of medieval Paternoster Row. The pipe had an internal diameter of 90mm and survived in two sections 3m and 4m in length. It was made of lead sheeting bent outwards and then together for a soldered lengthways seam, angled along the top. The pipe trench would have been at least 2m below

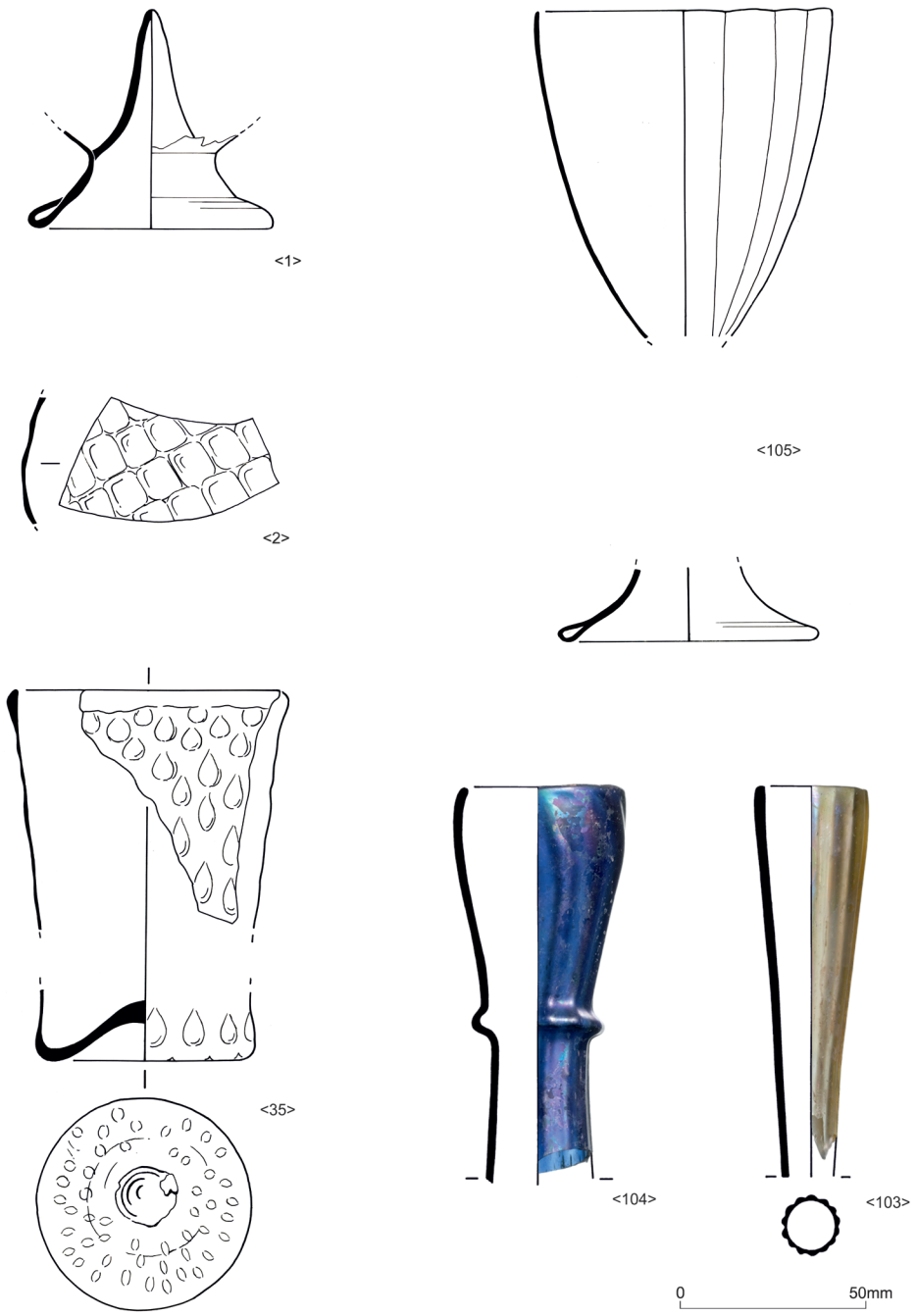


Fig 16. Glass vessels from medieval pits <2>, <1>, <35>, <36>, <103>, <104>, <105> from Site A (scale 1:2)

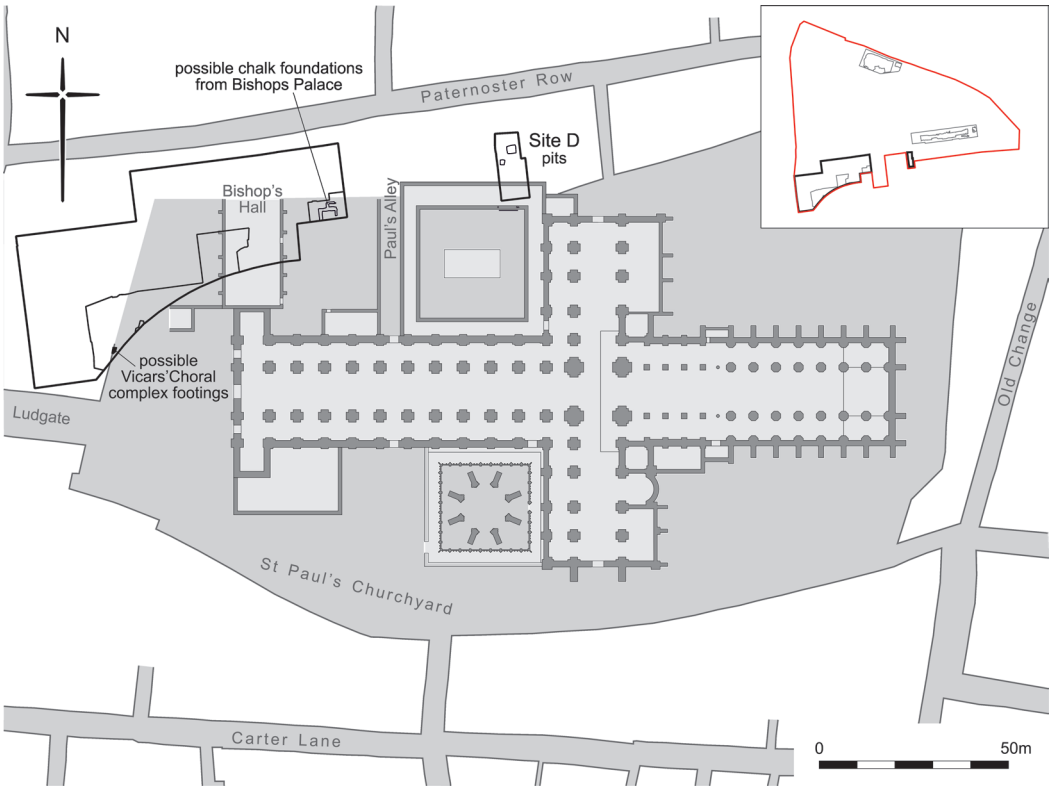
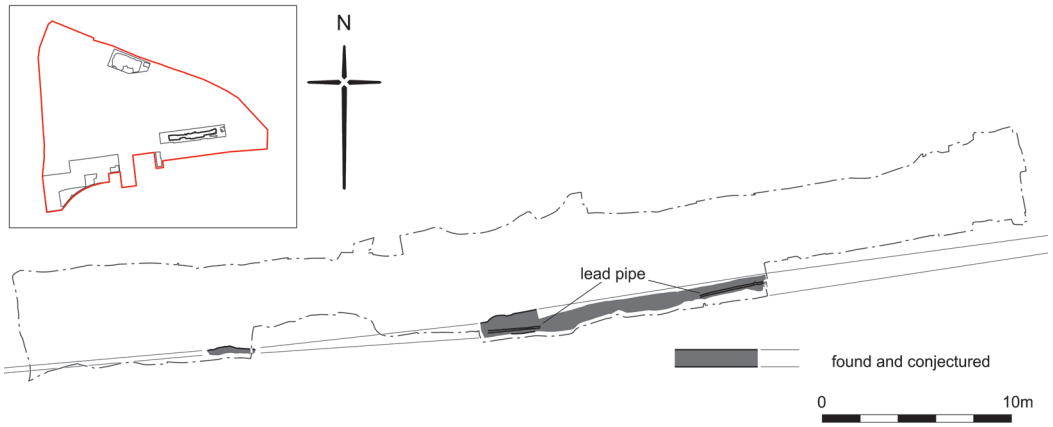
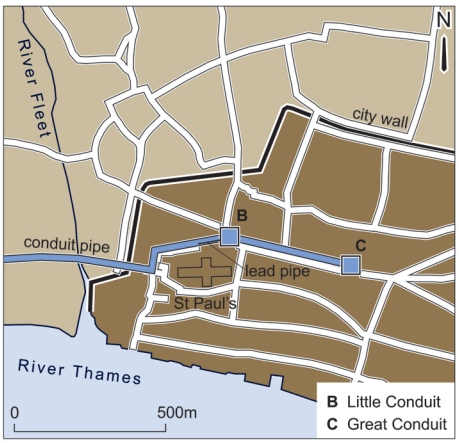


Fig 17. Chalk and ragstone foundations relating to the Bishop's Palace and the Vicars Choral complex from Site A and pits from Site D in relation to the Bishops' Palace in 1450 (after fig 4.48 in Schofield 2011) (scale 1:2000)

the contemporary medieval street level and could be traced for a distance of about 30m along the site (Fig 19). The form and location of the pipe suggests it was part of the system leading to the Great Conduit in Poultry, established in 1230–40 to provide London's first public post-Roman water supply (Fig 18; Burch & Treveil 2011, 179). This pipe carried water from springs at Tyburn along Oxford Street to the Strand and behind properties along Fleet Street. Later it was extended to springs at Paddington, accounting for the several street names incorporating conduit at Paddington and the West End today. The conduit pipe is known through cartographic and documentary sources to have ascended the west side of Ludgate Hill and skirted the northern boundary of St Paul's Cathedral precinct (*ibid*), along the full length of Cheapside to a stone chamber at the eastern end of the street, known as the Conduit House (Keene 2001, 175). The water was available to the general public; the scheme was financed by a combination of the citizens, the king and merchants who gained trading rights in the City. The eastern section of the pipe included a basic joint in which two lengths of pipe were dovetailed together. This part of the pipe was deformed and corroded as a result of the digging of a small pit, the backfill of which contained finds dated to the 13th–15th centuries. It is known that the entire route of the original pipe had inspection points and taps situated at intervals along its length to allow for cleansing and the release of air (*ibid*), and also that householders would tap into the pipe to gain access to the water for their own use; perhaps this small pit relates to a disturbance of this kind. The pipe and the Great Conduit were both out of use by 1666, by which time some of the more affluent householders in the City had their own piped supply of water.





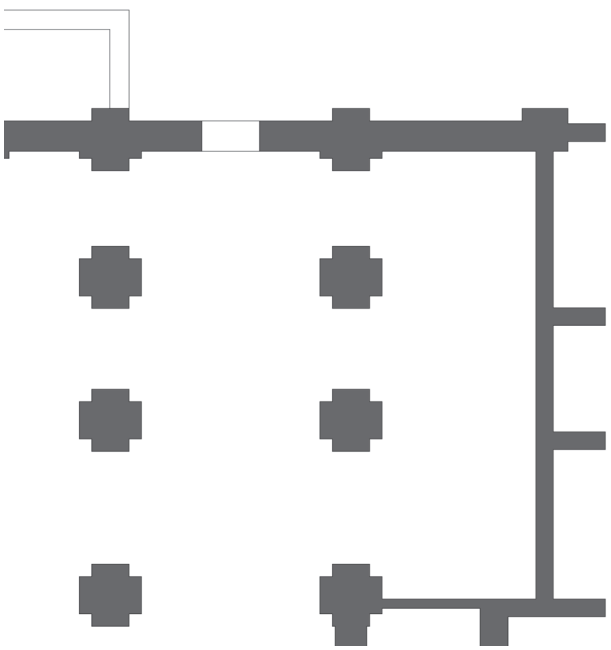


Fig 18. Route of conduit pipe in 13th century (adapted from fig 147 in Burch & Treveil 2011) (scale 1:400)

Fig 19. Lead pipe forming part of conduit under excavation on Site C, with repair to pipe in foreground

CONCLUSIONS

Although the excavations across Paternoster Square often revealed fragmentary and truncated remains, nonetheless important conclusions can be drawn about the post-Roman development of this area of the City of London. The portion of the 'western stream' that was relocated is reinterpreted as part of a north–south-aligned man-made ditch or watercourse, which was previously believed to be of Roman date. The lower fills of this watercourse which were the subject of geoarchaeological investigation, have now been radiocarbon dated to the Early and Middle Saxon period. Ideally, these dates should be confirmed by full excavation of this feature. The radiocarbon dates from this watercourse indicate that it predates the large scale reoccupation of the walled Roman city (generally dated to after *c.*AD 900) (Burch & Treveil 2011, 20) by several centuries and may be linked with the establishment of the 7th-century cathedral. So potentially this ditch is the earliest Saxon feature known in the City of London and if further fieldwork confirms this hypothesis, it would be a major addition to our knowledge of that period. Further evidence of Middle Saxon activity was provided by the discovery of residual sherds of Ipswich ware.

The later discoveries contribute towards our knowledge of the cathedral precinct from the Late Saxon period onwards, and some of the high status finds provide evidence of the feasting that would have occurred both in the religious and secular establishments within the area. The high quality glass vessels recovered from two pits on Site A probably came from the household of the Bishop of London. Interestingly, the bishop did host a wedding feast to celebrate the marriage of Prince Arthur and Katherine of Aragon, which took place in the cathedral on 14 November 1501 (Nichols 1852, 27). In addition the discovery of a length of the conduit pipe has helped to confirm the line of this crucial piece of medieval London's infrastructure.

APPENDIX 1: REPORT AND CATALOGUE OF ILLUSTRATED MEDIEVAL GLASS VESSELS FROM MEDIEVAL PITS ON SITE A

John Shepherd

Nineteen fragments of glass were submitted for identification from Site A contexts [72] (5 fragments), [73] (7 fragments) and [77] (7 fragments). All are quite substantial fragments permitting a reasonably accurate identification of the forms and types of vessels. This good state of survival may be due to the manner in which they had been deposited (see discussion below). A complete catalogue is available from LAARC under the site code SLY00.

All 19 fragments are described below. In brief, they all date to the 15th–16th centuries, but consist of common vessels from local glasshouses as well as higher quality vessels that have been imported into London from a considerable distance. The 19 fragments represent a minimum of 10.

A beaker base ([72] <39>) could come from either of the last three in Table 2 (<36>, <40>, <38>). All 19 fragments are catalogued below according to vessel type — tazza, containers

Table 2. Glass catalogue

Context	Accession no.	Description
[73]	<2>	A tazza (probably Italian)
[77]	<104>	A blue flask (probably Italian)
[73]	<171>	
[77]	<103>	A colourless flask (probably Italian)
[73]	<1>	
[73]	<3>	A wrythen bottle (probably Kent/Sussex Weald)
[73]	<170>, <173>	A plain bottle (probably Kent/Sussex Weald)
[77]	<105>	A beaker with vertical ribs (probably South France or Italian)
[72]	<35>	A beaker with lozenges (probably Kent/Sussex Weald)
[72]	<36>	A beaker with trail decoration (probably Kent/Sussex Weald)
[72]	<40>	A wrythen beaker (probably Kent/Sussex Weald)

(flasks and bottles) and drinking vessels. Within the last two categories, the fragments are ordered according to the quality of the vessel, *ie* coloured, colourless, naturally coloured decorated and naturally coloured plain.

Catalogue

Tazza

[73] <2> (Fig 16)
Two fragments from the body of a wide dish or tazza. Optic-blown; colourless glass with a faint green tint. Decorated with a diaper pattern in low relief.

Containers (flasks and bottles)

[77] <104> (Fig 16)
Fragment from the upper part of a tall flask. Optic-blown; blue glass. Fire-rounded rim. Neck of flask decorated with relief vertical ribs. Integral angular collar in the neck. Probably from same vessel as <1>.

[73] <171>
Fragment from the body of a bulbous-bodied vessel, probably a flask. Optic blown; blue glass. Decorated with broad low relief vertical ribs. Probably from same vessel as <104>.

[77] <103> (Fig 16)
Four fragments from the upper part of a tall flask. Optic-blown; colourless glass with a faint green tint. Decorated with relief vertical ribs. Probably from the same vessel as <1>.

[73] <1>
The base of a flask. Optic-blown; colourless glass with a faint green tint. Decorated with low relief vertical ribs, visible also on underside. Very high, pointed kick in base. Probably the same vessel as <103>.

[73] <3>
The rim of a bottle or flask. Optic-blown; natural green glass with surface decomposition. The rim is fire-rounded and fashioned into a wide mouth. Body decorated with low relief 'wrythen' ribs. Possibly the same vessel as <170>, <173>.

[73] <170>; <173>
Two fragments from the base of a bulbous-bodied plain bottle. Free-blown; natural green glass with surface decomposition. The base has a domed kick. Possibly the same vessel as <3>.

Drinking vessels (cups and beakers)

[77] <105> (Fig 16)
Two fragments from the rim, side and base of a wide-mouthed beaker. Optic-blown; colourless glass with a faint grey tint. Decorated with low relief ribs. Fire-rounded rim. Pushed in, pedestal base ring.

[72] <35> (Fig 16)
Fragment from the base and lower part of a beaker, probably a squat cup. Optic-blown; natural green glass. Slightly pushed-in base. Body and underside decorated with low relief, vertically set lozenges.

[72] <36> (Fig 16)
Fragment from the rim and side of a tall beaker. Free-blown; natural green glass. Rim fire-rounded and slightly sloping inwards. Decorated with a self-coloured spiral trail below the lip.

[72] <40>
Fragment from the rim and body of a tall beaker. Optic-blown; natural green glass. Body decorated with low-relief 'wrythen' decoration.

[72] <38>
Fragment from the rim of a tall beaker.

Free-blown; natural green glass with surface decomposition. Rim fire-rounded and slightly sloping inwards.

[72] <39>
Fragment from the hollow-tubular pedestal base-ring of a tall beaker. Free-blown; natural green glass. Probably from one of the beakers described above (<36>, <40>, <38>).

Discussion

Tazza

The fragments from the bowl of a vessel (<2>) are in a very good colourless glass and the vessel has been well made with a sharp, low relief diaper pattern over the whole of the body. It is difficult to be certain about the precise form of this vessel, but it is probably from one of the distinctive late medieval 'tige' forms common among contemporary French assemblages (*eg* Tyson 2000, 58, fig 6, g19). It has been suggested that such vessels were the products of glasshouses in the Argonne region (Baumgartner & Krueger 1988, 250–8, nos 258–79). The optic-blown decoration of such vessels tends to be in much lower relief than this example. However, such vessels date from the mid- to late 14th century — for example a mid-14th-century vessel from Winchester (Assize Courts Ditch, Baumgartner & Krueger 1988, 257–8, no. 280) and an earlier late 13th- to mid-14th-century example from Old Custom House, London (Tatton-Brown 1974, 184–5, no. 24, fig 3 5).

Containers

The tall flask with narrow neck and bulbous body on a high pedestal base ring is a common form in medieval Europe and is likely to be a product of the Italian glasshouses, where these seem to be more common and among the earliest dated. They are decorated with wrythen decoration or, as here, with broadly spaced vertical ribs, a decoration known as 'fluting'. In general, the type dates from the 14th century through to the 16th century (Tyson 2000, 130, Type D20). Their main period of production and use would appear to be the late 14th and 15th centuries.

The example in blue glass (<104>) with an integral collar is rarer than the plain versions. Tyson suggests (2000, 130) that this collar was inspired by earlier Islamic style vessels, the collar acting as a string rim to prevent a cord attached to a stopper from sliding from the neck of the bottle when it was inverted. She cites plain, Western examples with 'bulges' in their necks from Italy — in particular in a pit dated 1390 in Tarquinia (Whitehouse 1987) and ribbed examples from 14th-century contexts in Monte Lecco, Italy (Stiaffini 1991, 241–2, fig VII,2). Three, all in colourless glass, come from London, all from unknown provenances (MoL Acc Nos 22528, 25011, A26052).

The colourless flasks with vertical ribbing are more common. Tyson quotes examples from Tarquinia, Italy in the pit dated to 1390 mentioned above (Baumgartner & Krueger 1988, 47, fig 46); 14th-century examples in Venice (Mentasti *et al* 1982, 66–7, nos 41–2); and an early 17th-century example from Saint-Denis, near Paris, (Foy & Sennequier 1989, 313, no. 340).

Other English parallels similar to <103> come from a 16th-century context in Southampton (Charleston 1975, 218–20, nos 1522 and 1536) but all datable London examples come from late 14th- to 15th-century contexts. Three come from Milk Street (with associated pottery dated to *c.*1350–1400: MLK72 <112>, <115> and <161>) and one from Trig Lane (with associated pottery dated to *c.*1440: TL74 <1178>). Two from Post Office Court, 1–3 Abchurch Lane (GM1) and one from Gateway House, Watling Street (GM160) come from contexts broadly date to the 15th century (MoL Acc Nos 16641, 16643 and 21432 respectively). There are a further 13 examples from London from unknown sites (MoL Acc Nos 5125, 5126, 5217, 12415C, 16575, 22526, 22527, 24636A, B & C, 25005, 80.12/36 and 5124).

Bulbous-bodied bottles (<3>, <170>, <173>) with tapering necks, outsplayed rims, bases with low domed kicks and plain bodies or with spiral, low relief mould-blown ribs ('wrythen') on the bodies were especially common in the second half of the 16th and the first half of the 17th centuries (nos 166–79) — *eg* London (Noel Hume 1957, 106, nos 5 and 7); Basing House (Charleston 1971, 66, nos 28–9, fig 28); Southampton (Charleston 1975, 223, 1573–7); Chichester (Charleston 1981, 224, no. 11, fig 8.54); Linacre Gardens, Canterbury (Shepherd 1990, 212–14, nos 241–7, 250, 264–72). Examples in late 17th-century contexts at Nonsuch Palace show that this was a long-lived, functional type. It begins at a much earlier date,

however, and it would not be unreasonable to suggest that this form, 200–270mm high and accompanied by some smaller and larger variations, was the standard late medieval glass bottle. Amongst the earliest occurrences of this form are a near complete plain example from a context dated 1300–50 at High Street, Southampton (Charleston, 1975, 218–19, no. 1519, fig 222) and the fragments from the early 14th-century glasshouse site at Blunden's Wood, near Hambledon, Surrey (Wood 1965, 65–7). The earliest datable London example was found on a site in Milk Street (MIL72 <112>) in a context dated to the second half of the 14th century. Wrythen examples, such as <3>, date as early as the late 13th or 14th century (see Tyson 2000, 158–60, for references to numerous examples from the late 13th century onwards).

Drinking vessels

The colourless beaker with vertical ribbing (<105>) is particularly well made in a good quality glass, and is the best example of a drinking vessel among this entire assemblage. The quality of the glass suggests an Italian source but the form, if the base fragment and the body are from the same vessel, is more reminiscent of southern French drinking vessels, such as those from Martigne dating to the end of the 15th century (Foy 1989, 260–3, type E3). These, however, tend to be in a greenish colourless glass and are not as well made as this example. The precise origins, therefore, remain a mystery but a broad southern French/north Italian source is likely. It is far too good a quality to be a northern European vessel of this date.

The tall, almost cylindrical beaker (<36>, <40>, <38>, <39>) fashioned with either a pushed-in base forming a pedestal foot (such as <39>) or with plain trail or 'rigaree' base-rings (not represented here) or with a simple base were probably designed for beer drinking (Charleston 1972, 1336, fig 64, 64). The former, tall beakers with a pedestal foot, should be regarded in Charleston's opinion (1981, 88) as a type-fossil on English glassmaking sites dating to the second half of the 16th and the beginning of the 17th centuries — *eg* Rosedale and Hutton (Charleston 1972, 136–41, fig 61, 23–6; fig 64, 64–82; fig 65, 83–4 and 87–92), Woodchester (Daniels 1950, pl VII, 48–53), and many Wealden sites (Kenyon 1967, pls xiv,a; xvi,i; xvii,g–h). These statements by Charleston, especially, have led this form to be established as a late 16th- or 17th-century commonplace (Wilmott 2002, 45–6). However, Tyson rightly notes that the use of these vessels, with wrythen and bossed relief decoration, extends back into the 15th, perhaps even the late 14th, century (2000, 82). Examples are known in a waterfront dump at Baynard's Castle, London associated with pottery dated to *c.*1400–50 (Keys 1998, 232, no. 664), a cellar deposit sealed by fire debris dated to 1507 at Norwich (Atkin *et al* 1985, 58 and 62) and a mid- to late 15th-century context at Northampton (Oakley & Hunter 1979, 299–300, GL74).

The squat beaker, <35>, is probably not of this tradition. The glass is quite good quality and the shape is reminiscent of German examples, also of the 15th century (Baumgartner & Krueger 1988, 308, nos 358–9).

APPENDIX 2: RADIOCARBON DATING

Mary Ruddy

Full details concerning the radiocarbon dates and sample provenance are included in the site archive (available at the LAARC). The dates are quoted in accordance with the international standard known as the Trondheim convention (Stuiver & Kra 1986). Calibrations were made using Oxcal 4.1 (Bronk Ramsey 2009; https://c14.arch.ox.ac.uk/oxcal/OxCal.html) and the

Table 3. Details of radiocarbon dates

Laboratory code	Sample	Radiocarbon age (BP)	Calibrated date (AD) (95% confidence)
Beta 165048	Peaty deposit	1260±70	650–950
Beta 165049	Organic refuse	1040±50	890–1150
Beta 192217	Peaty deposit	930±40	1020–1210
Beta 192218	Organic refuse	990± 40	670–870
Beta 192219	Humic muds	1350±40	650–780

IntCal09: Northern Hemisphere calibration curve (Reimer *et al* 2009). The calibrated dates are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 5 years where the error on the determination is ±25 or less, or to 10 years when the error is greater than this.

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Credit for persevering with the theory that the 'western stream' was in fact a major Saxon feature should go to Bruno Barber, who supervised the excavations on Site A. The other excavations were supervised by Nick Holder (Site D), Kieron Heard (Site C), and the author (Site B), the watching-brief on Site A by Lindy Casson, and the evaluation on Site D by Carrie Cowan. There were many members of the MOLA field team who worked on the sites, too many to mention individually here, but we would like to thank them for their hard work and more complete lists of those concerned are provided in Watson 2006. The author would like to acknowledge information provided on other nearby excavations by colleagues Robin Wroe-Brown and Al Telfer. Project management was by Nick Bateman and David Bowsher. MOLA would also like to particularly thank John Schofield for providing unpublished information and plans as well as giving advice on the archaeology of St Paul's and for steering this paper to its conclusion. The pollen analysis was undertaken by Rob Scaife of the University of Southampton, the diatoms by Nigel Cameron of the Department of Geography, University College London. Geoarchaeological work was undertaken by Jane Corcoran. The radiocarbon dates were initially calibrated by Jane Sidell when she was English Heritage's Regional Science Advisor and were later re-calibrated by Mary Ruddy of MOLA Geoarchaeology. The glass assemblage was examined by John Shepherd. Site photography was by Maggie Cox, studio photography by Andy Chopping. Surveying and the production of plans was by Catherine Drew and MoLAS Geomatics. The drawings were produced by Sandra Rowntree and Judit Peresztegi.

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