THE HISTORICAL DEVELOPMENT OF SOMERSET HOUSE: AN ARCHAEOLOGICAL INVESTIGATION

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SUMMARY

The Oxford Archaeological Unit carried out a series of archaeological investigations funded by the Heather Trust for the Arts in the South Wing and River Terrace of Somerset House, the Strand, Westminster, prior to conversion to hold the Gilbert Collection. The investigations consisted of a building survey of the basement and mid-basement levels of the South Wing and River Terrace, and detailed recording of the mezzanine timber floor of the River Terrace which was to be removed. The main area of below-ground impact was the excavation of the River Terrace, including the remains of the 18th-century Bargehouse, the lowering of the floor of the South Wing and the insertion of lift pits, air ducts, and a newer sewage system which affected the partition walls and relieving arches within the building. In the course of these investigations the riverside wall and parts of the gardens associated with the Tudor palace which occupied the site before Somerset House were uncovered. A series of analyses on pollen, diatom, plant, and mollusc remains indicates something of the character of the economy and environment of this palace. Within Somerset House itself the original form of the dock for the royal barge and its associated pump-house was revealed as well as other aspects of the construction of the building. The trussed floor of the River Terrace and other aspects of the Georgian structural carpentry revealed in the building survey are discussed.

INTRODUCTION

Somerset House is a major 18th-century government office building fronting the Thames on the site of an older urban palace. It is a Grade I Listed Building and lies within an Area of Special Archaeological Priority as defined in the Unitary Development Plan for the City of Westminster (1991). As a condition of the planning consents the Oxford Archaeological Unit (OAU) was commissioned by Peter Inskip and Peter Jenkins Architects on behalf of The Heather Trust for the Arts to undertake a programme of investigation and recording in response to the conversion of the South Wing and River Terrace to accommodate the Gilbert Collection. This paper presents the results of the building survey and field investigation carried out by the OAU.

BACKGROUND

Site location

Somerset House lies to the south of the Strand (NGR TQ 3075 8075) and is bounded to the south by the Victoria Embankment, to the east by King's College, and to the west by Lancaster Place (Fig 1). The conversion affected only the southern part of the property, comprising the South Wing and the River Terrace. Alterations were made in several parts of these buildings. The River Terrace, including the Great Arch and Bargehouse, was substantially cleared of below-floor deposits, and the original trussed mezzanine floor was removed. The floor of the South Wing was lowered and lift shafts were

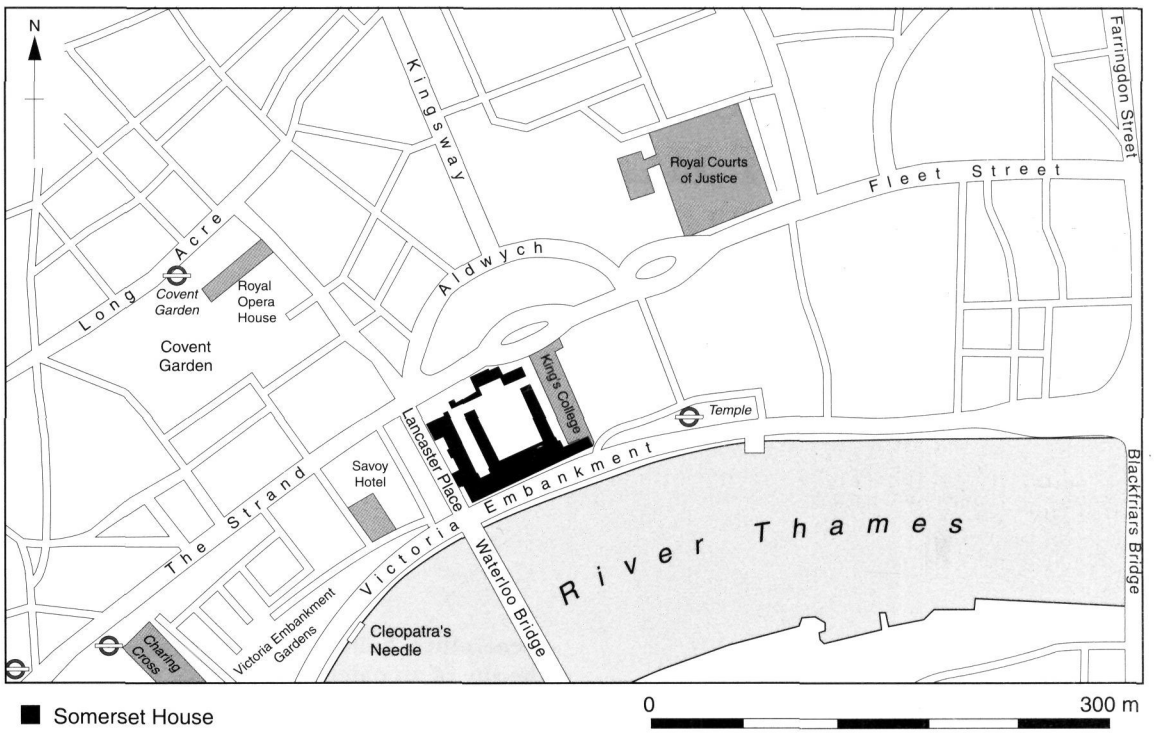

Fig 1. Location map

excavated. In addition, a number of air ducts, sewage pipes and associated manholes were cut from the River Terrace into the South Wing across the lightwells that lie between these two parts of the building, and numerous minor alterations were made.

Previous work

Thirty-five test pits were excavated at Somerset House by the Museum of London Archaeology Service (MoLAS) between August 1996 and October 1997 in order to provide technical information about the foundations of the 18th-century Somerset House, to produce a detailed plan of the alignment of the Tudor river wall in relation to the existing building, and to assess the archaeological impact of the current renovation proposals (Chew 1997, fig 29).

These test pits revealed the Tudor foreshore and river wall as well as certain features of the gardens which lay behind them. The wall was well preserved beneath the later building. Tudor and post-medieval deposits overlay the foreshore and abutted the river wall. The remains of the 18th-century Bargehouse were found overlying the foreshore, which had been partially truncated by the foundations of the South Wing and River Terrace. Exposed areas of the Tudor river wall and the foundation trenches for the River Terrace and the South Wing were themselves sealed by 18th-century dumps and features deriving from various phases of remodelling. The Bargehouse was backfilled in the 19th century following the creation of the Victoria Embankment.

Archaeological and historical background

The historical development of the Somerset House site has been treated in the *History of the King's Works* (Colvin *et al* 1976; 1982), more recently by Newman (1990), and in studies of William Chambers (Harris 1970). The 'Somerset House Conservation Plan' (Inskip & Jenkins 1997) now forms a fundamental account of the building, comprising a general description, detailed surveys, and a collection of subsidiary data covering the whole of the building's history.

Saxon

The identification of the middle Saxon town of *Lundenwic* beneath the Strand and Covent Garden provided one of the reasons for designating this an Area of Special Archaeological Priority (City of Westminster 1991). Excavations at Arundel House carried out by Pre-Construct Archaeology, which ran concurrently with the excavations at Somerset House, identified timber revetments that are believed to relate to the Saxon period. However, little evidence for Saxon activity has been identified on the site of present-day Somerset House. The excavations undertaken by MoLAS recovered three Saxon sherds (Chew 1997, 131). A small quantity of Ipswich ware from a testpit beside the Courtauld Institute library observed by the OAU in 1998 has now also been identified.

Later medieval

From the late 12th century the area along the Strand became a focus for the construction of the London residences of nobles and ecclesiastics. Anthonis van den Wyngaerde's panorama of London in 1543 clearly shows that the area of Somerset House was occupied by Thameside gardens and townhouses, inns such as those of the Bishops of Chester, Worcester and Llandaff, and by the churchyard of St Mary le Strand (Schofield 1995).

Post-medieval

Between 1547 and 1550, Edward Seymour, the Duke of Somerset and Lord Protector, ordered the demolition of the medieval buildings on the site, including the church of St Mary le Strand, to make way for the construction of Somerset Palace. The date at which this palace was completed is not known. Agas' map of 1551 clearly shows Somerset Palace with a formal garden and the river wall with a flight of steps stretching down to the river, though the building is recorded as having still been unfinished in 1598.

The Duke did not live long to enjoy his new residence. Following his execution in 1552 the new house was confiscated and became the residence of Princess Elizabeth who lived there until 1558. Henceforth its history was recorded in the records of the King's works. Part of the house was later returned to the Duke's son, the rest being used as grace and favour apartments during Elizabeth's reign (Colvin *et al* 1982). The house was subsequently used as the residence of Anne of Denmark, Queen of James I, and by Henrietta Maria, Queen of Charles I. The chapel and grounds sustained some damage when they and the palace were occupied by Parliament during the Civil War. Following the Restoration the palace was returned to Henrietta Maria. Construction of a gallery along the river front façade, believed to have been designed by Inigo Jones who died at Somerset House in 1652, began in 1661. The development was, however, suspended in 1664 for financial reasons. The gardens were later relaid in the Italian style, and survived long enough to be recorded in plans (Fig 2) and various views and paintings of Thameside London.

Following an Act of Parliament proposing the construction of the first purpose-built government offices, work on the present Somerset House began on 26 May 1775 (Colvin *et al* 1976). The building was eventually designed by Sir William Chambers who began work in 1776 on the present North Wing. The East, West and South Wings were added later around a central courtyard, raising the ground level substantially above that of the old palace and garden. The River Terrace was completed by 1790, taking the building out onto the foreshore of the Thames. The Great Arch in the centre of the River Terrace gave access to the Royal Bargehouse and allowed boats and barges to reach a service entrance below the Navy Office. The latest of Chambers' building designs indicates that the King's Bargemaster was accommodated in part of the Navy Office and other apartments below the Terrace. The Bargehouse was infilled at the time of the construction of the Victoria Embankment by Bazalgette between 1864 and 1870.

Scope and methodology

The investigation consisted of two parts: a building survey and a watching brief. The methods employed in the building survey (Munby 1997) in the South Wing and River Terrace ranged from general assessment of the fabric and recording of its appearance to detailed investigation and recording of the fabric where it was to be altered or removed. The floors were recorded in plan, section, and detail drawings prior to removal; a general photographic survey was supplemented by

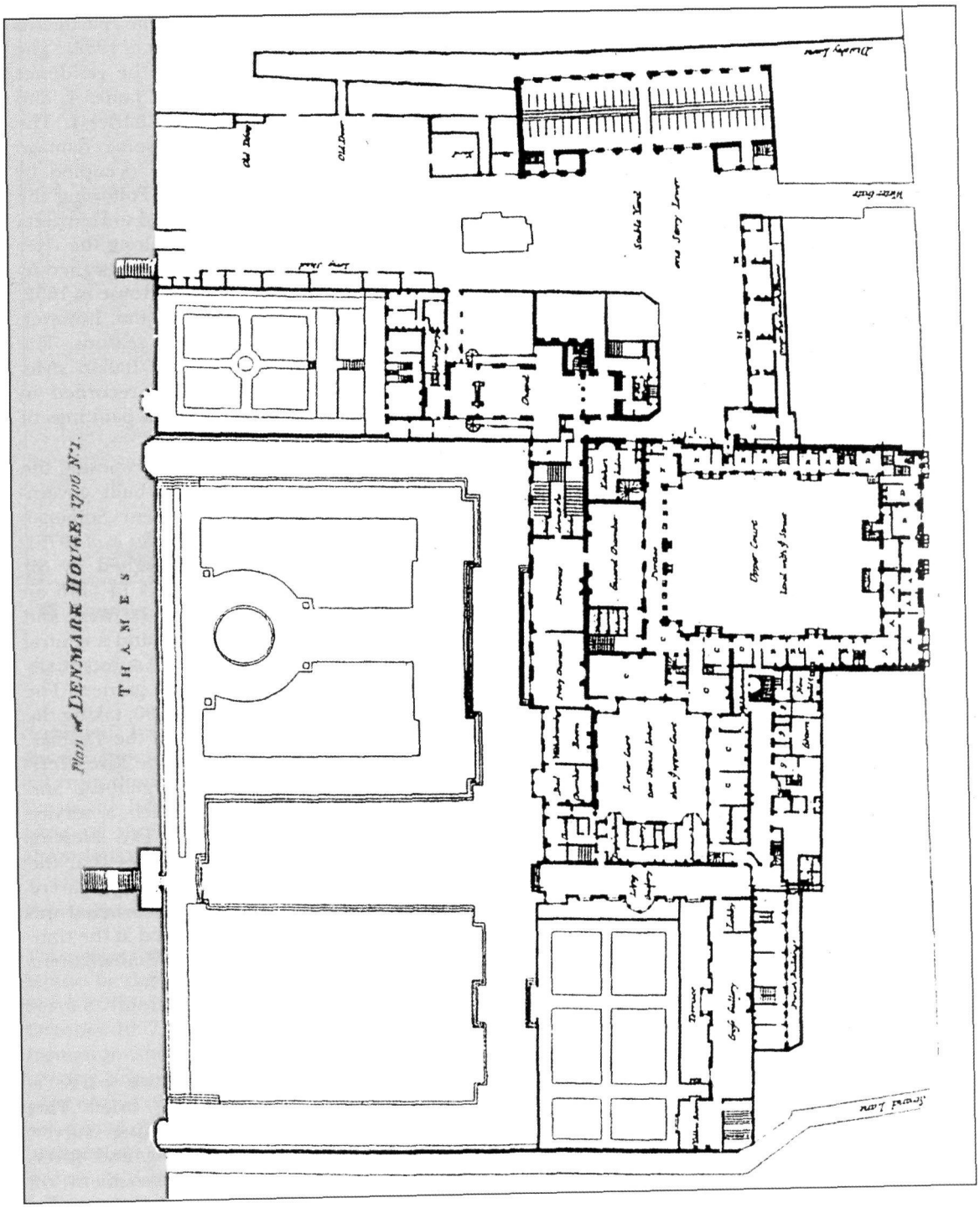

Fig 2. Needham and Webster's plan of Somerset House, 1706

photography of individual works before and after alteration. Extensive written and sketched notes of the investigations were supplemented by more detailed context-based recording as required. Samples of materials were taken for comparative study, and a selection of artefacts, especially paper, ceramics, and bone, was made from those found within the building fabric. A few fragments of the trussed floors have been retained.

The watching brief covered all of the excavations relating to the conversion and renovation of the buildings. No excavations took place purely for the analysis or assessment of the archaeological resource, although provision was made for further excavation of the 18th-century Bargehouse and of garden features to the north of the Tudor river wall beyond the limits defined by the conversion design.

Buried structural features relating to Chambers' Somerset House were recorded as they were exposed, and where possible they were identified using documentary and pictorial sources. A detailed record was made of any deposits relating to the Tudor gardens and structural features of the river wall, and of deposits sealed by Chambers' original floors which may have contained demolition material from Somerset Palace. The majority of the material actually found was, in fact, unworked and was recorded before being discarded. The records are now held by Somerset House Ltd.

The excavation was conducted by contractors under archaeological supervision so that archaeologically sensitive material could be investigated and recorded when encountered. The level of supervision varied: in areas of minimal impact the archaeologist observed the contractors' excavation; in more sensitive areas the archaeologist controlled the contractors' excavation. Excavations within the South Wing and the east and west lightwells were carried out entirely by hand. Excavation within the River Terrace was carried out both by hand and by a mechanical excavator with a toothless bucket.

THE TUDOR PALACE (Figs 3–4)

Excavations within the South Wing and in the western lightwell (between the South Wing

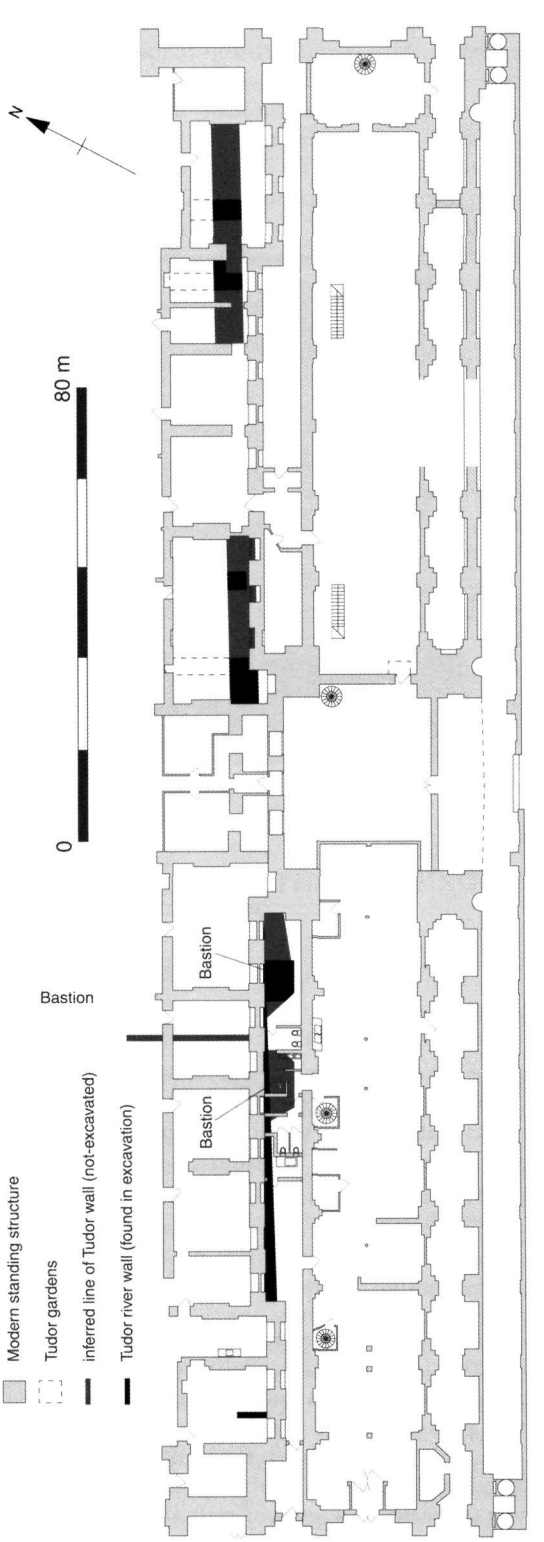

Fig 3. Plan of the Tudor river wall and features of the gardens of Somerset Palace

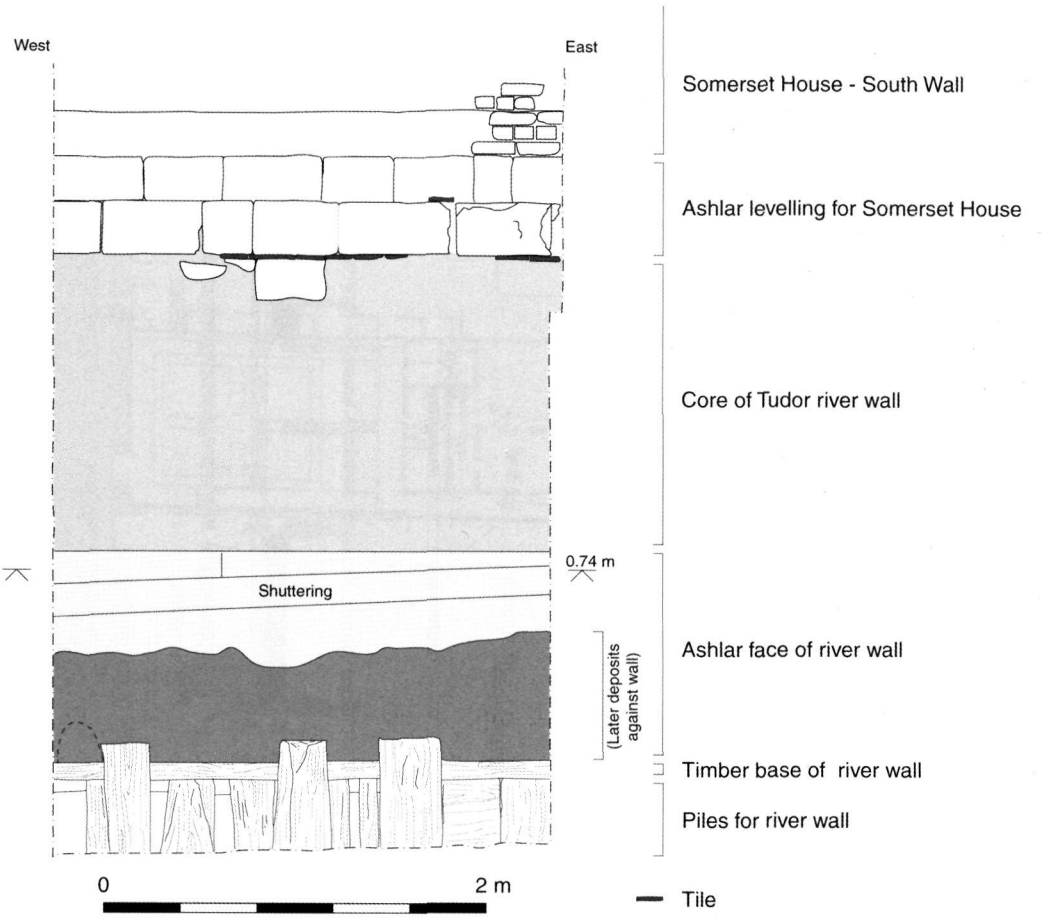

Fig 4. South-facing elevation of the Tudor river wall with Somerset House above

and the River Terrace) revealed several features related to the Tudor Somerset Palace, including the river wall and two bastions projecting from it, two walls forming the boundaries of the palace's gardens, and path or yard surfaces dating from the later phases of the garden.

The river wall

A length of the southern face of the Tudor river wall *c.*20 m long, running slightly obliquely to the existing building, was revealed at various levels in the excavations in the western lightwell (Fig 3). The wall was faced with Portland ashlar which covered a limestone rubble core. The ashlar facing survived to a level of only 0.84m OD, but the core to 2.36m OD. The core was supported by a dense raft of elm piles capped by a 0.1m-thick elm base plate at a level of -0.26m OD (Fig 4). These timber foundations were revetted by a series of elm posts up to 0.3m thick. To support the base plate the tops of the timbers were all cut with a 0.05m wide lap joint, indicating that both were constructed at the same time. The posts were driven through a layer of grey silt which contained a single sherd of 15th-century Surrey White Ware. Samples for environmental analysis were taken from this deposit, and from the deposits above which had built up around the pile foundations of the river wall (see below 'Environmental evidence').

The rear face of the Tudor river wall was exposed at various levels in two trenches below the eastern end of the South Wing. The core of the wall survived here to a level of 2.81m OD, and a section of the wall's parapet to a height

of 3.59m OD. The rear face was constructed from Greensand with inclusions of chalk and limestone. The riverside face had been robbed of the Portland ashlar blocks, presumably during the construction of the present-day Somerset House.

No construction cuts for the Tudor river wall were visible, suggesting that it was a free-standing construction built from a lower level, and that the garden deposits had subsequently built up against its rear face.

The bastions and stepped ashlar

The excavations in the western lightwell also confirmed the location of two bastions projecting from the river wall which are shown in plans of the palace (Fig 2). The western bastion, originally roughly trapezoidal in plan, had been truncated by the north wall of the River Terrace and by an 18th-century brick culvert. Its rubble core survived to a height of only 0.16m OD on either side of this culvert. Its face was exposed for a depth of 0.2m. Only two of the Portland ashlar blocks which originally faced the bastion survived *in situ*, although the position of a third was identified. It was supported by a lattice of elm planks, five of which were identified in plan. The three north–south orientated timbers were 0.15m thick and were laid 0.2m apart. The two east–west timbers were 0.28m wide and set 0.14m apart. The depth of the foundations could not be ascertained due to the confines of the trench. A grey-brown silt consistent with natural Thames foreshore silts was identified between the elm timbers. No datable material was recovered from this deposit.

The eastern bastion consisted of a trapezoidal outwork faced with Portland ashlar. It had been truncated to a level of 0.85m OD, and, although its south face was exposed to a level of 0.15m OD, no foundations were identified.

A series of seven offset courses of Portland ashlar overlay this bastion to a level of 2.88m OD. Although this construction was not part of the original river wall it did follow its alignment. Its date was unclear, but it probably formed part of a refacing of the Tudor river wall following the demolition of the bastion.

The garden walls

The reduction of the floor level within the South Wing exposed Tudor deposits in several areas north of the Tudor river wall. These included a roughly north–south aligned limestone wall which survived 0.15m below the existing brick floor near the western side of the present building. It was constructed from a mortar and limestone rubble core faced with irregularly sized, squared limestone blocks. It ran parallel to a similar construction identified by MoLAS further east. The alignment of both walls, and their positions relative to the bastions, follows that of the walls of the chapel garden shown on the survey map of 1706 (Fig 2).

Garden surfaces

In both of the areas where it was exposed, garden surfaces were found against the rear face of the river wall. These typically consisted of successive crushed tile and mortar or chalk surfaces interfaced with silty clay horizons. A total of six sherds of pottery was recovered from these deposits. The stratigraphically earliest context containing pottery was a crushed chalk floor which contained a single sherd of Frechen Stoneware dated to the late 16th or early 17th century. This was overlain by a second chalk surface which abutted the rear face of the Tudor wall.

SOMERSET HOUSE: THE BUILDING SURVEY

The River Terrace

The initial design (Fig 5)

The River Terrace was constructed out on the foreshore of the Thames to function as a grand riverside walkway in front of Somerset House, the internal spaces being used for utilitarian purposes. These were first intended to consist of a Bargehouse in the centre, and a stable and coach house at the west end for the Navy Commissioner's House, with the upper floor being used for storage and office space (Fig 5). The east end was intended to be a house for the King's Bargemaster. The River Terrace is perhaps less well documented than the rest of Somerset House and more reliance has to be placed on the plans, and especially the physical evidence found in the building, than is the case elsewhere. It is possible that the mezzanine floor was not originally planned, for the brick vaulted ceiling would have made a superb space for the Royal

Bargehouse. Nevertheless within the time that the building plans were being finalised it had been decided to put storeyed ends to the range, and to put a floor over the whole of the internal space, for this is all clearly of the primary building phase.

The difficult ground formation and heavy loading of a brick vaulted structure caused concerns from the start, and every effort was made to provide a secure construction. This was achieved by substantial foundations, the use of trussed floor joists at mid-basement level, and iron ties across the building in that floor and at the base of the vault (Fig 6). The recent works for the new gallery entailed the removal of the original mezzanine flooring in the western half of the building (the eastern half having already been cleared in 1872–74 for the insertion of the Probate Registry store).

The trussed mezzanine floor (Figs 6–7)

The mezzanine floor was of some considerable interest as an example of a short-lived experiment in 18th-century structural carpentry techniques. The removal of the timber floor allowed a detailed examination of its construction and the alterations made to it. Although the floor is not clearly apparent on the design drawings, its construction must have been contemporary with the building, as the relationship of the principal joists, the iron ties and the brick walls implies a simultaneous construction. The composition of the principals is of especial interest (Fig 7), being trussed girders of pine and oak, essentially consisting of a pair of substantial pine planks channelled to receive the members of an oak truss made of lengths running between individual dovetail wedges (like the joggle of a trussed roof). The system depended on the means of fixing the parts together: the oak trusses were wedged in place at the outer ends, while the pine planks were pinned together with six iron bolts (with screw nuts), and held in the walls with iron ties and external pattress plates. The intended principle of these girders was that they increased the potential loading through the vertical compression force on the beam putting the girder into tension through the action of the truss; that is to say that a vertical force

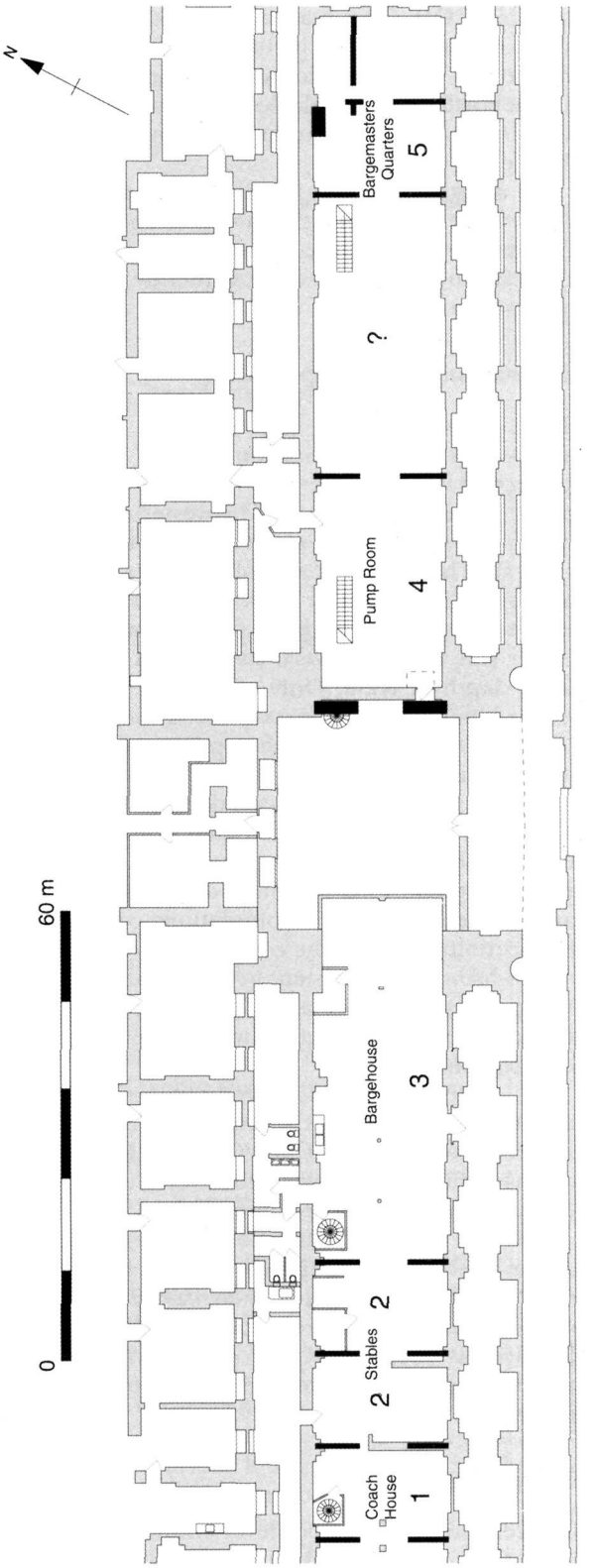

Fig 5. Plan of original functions of spaces in the River Terrace

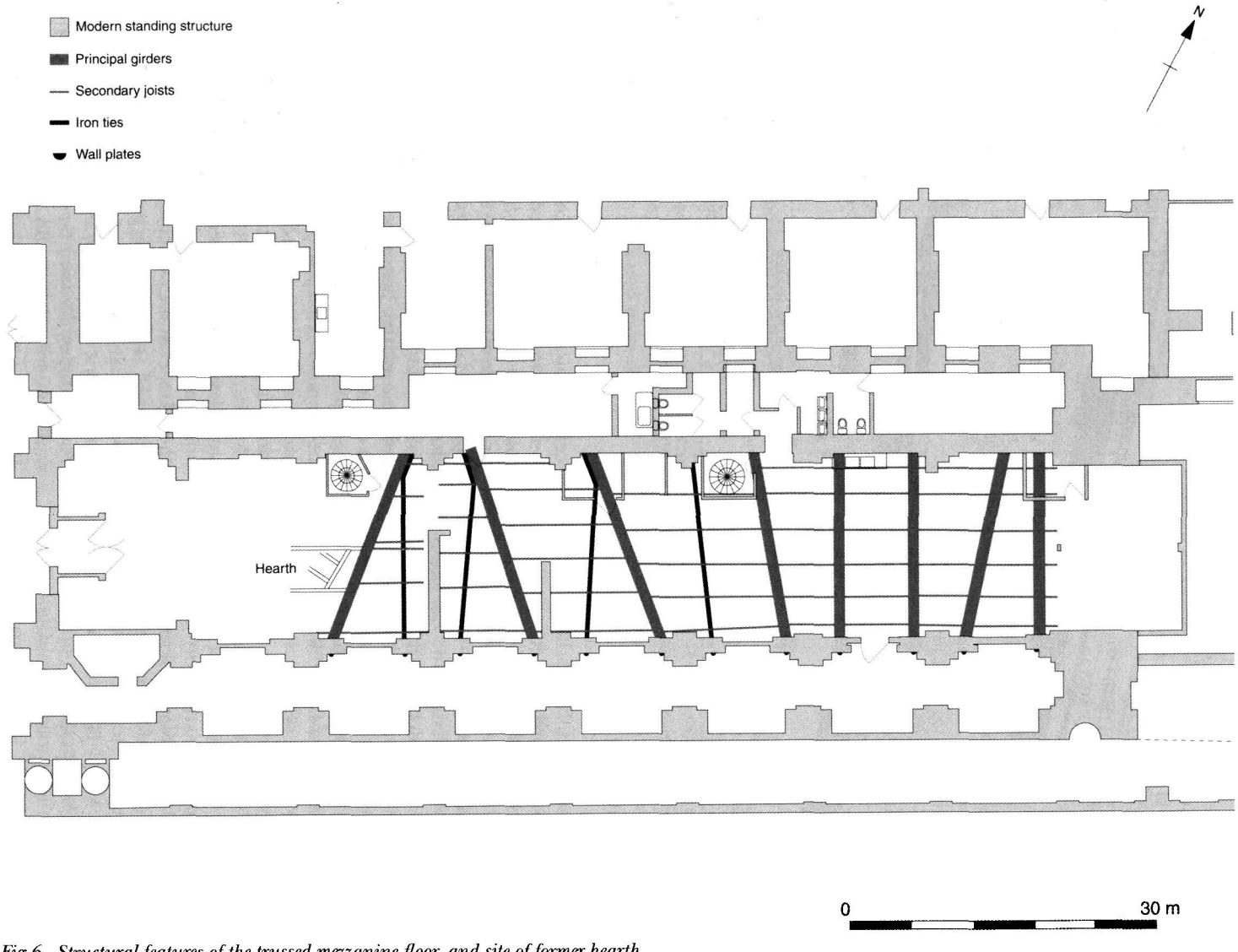

Fig 6. Structural features of the trussed mezzanine floor, and site of former hearth

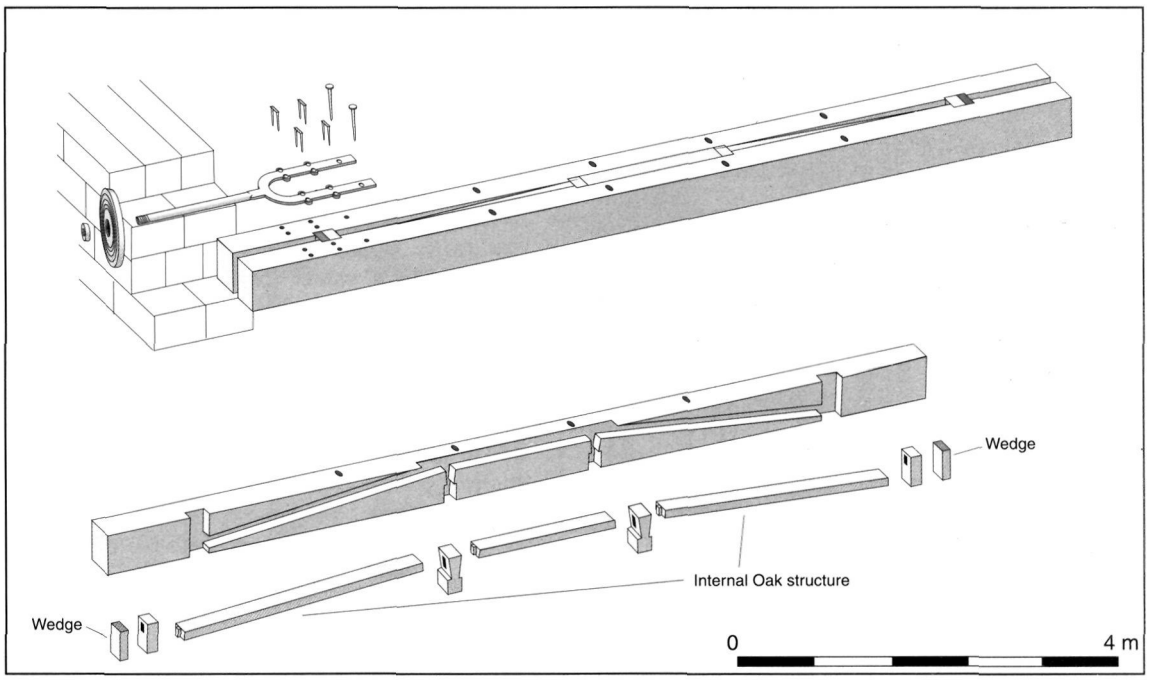

Fig 7. Composition of the trussed girders from the mezzanine floor (bolts omitted)

on top of the oak truss would be distributed to the side members acting on the wedges at their ends which would push out the ends of the pine planks with a resultant tensile effect on the whole. As Yeomans says, 'The intention of this trussing was to reduce the defection of long spanning beams which would otherwise sag noticeably under load, but it was also mistakenly thought that trussing strengthened the girder, possibly because stiffness was associated with strength at the time' (Yeomans 1992, 139).

The trussed girders were laid, as was the practice, either straight or diagonal, in order to avoid loading over windows and entrances. A consequence of the diagonal setting of principals was that a further series of iron tie rods was required to provide the regular series of ties and pattress plates flanking the windows; these were iron bars 40mm square, joined at the centre with a wedged scarf joint. The intermediate floor structure was of good quality, but unexceptional, with six secondary joists running off the principals (numbered in pairs from south to north: I, I, II, II, III, III), carrying both common floor and ceiling joists. While the common floor joists stand proud of the secondary joists, the ceiling joists (running between a mortice at one end to a chased groove at the other) are flush with the underside (soffit) of the joists so as to make a level surface for ceiling laths to be applied. A detail found throughout the original floors was the insertion of soundproofing below the oak floor boards: this consisted of a strip of lath and plaster between each pair of common floor joists, supported on battens nailed to the joists. While the numbering of the principals was not immediately apparent, the bays were clearly numbered on the centre of the secondary joists running east to west, starting from the centre (Nos III, IIII, V, [VI], VIII were observed on the surviving sections of primary floor).

The trussed floor was evidently in use from the 17th century, and was used by Wren, and described in various carpenter's manuals, such as James Smith, *Carpenter's Companion* (1733), Francis Price, *The British Carpenter* (1733), and Batty Langley, *Builder's Complete Assistant* (1741); it is of interest that the form used here (with the four oak joggles) is unlike that illustrated by Price (where the truss has no central horizontal section). By the 19th century iron bolts were substituted for the oak joggles, as illustrated by

Peter Nicholson, *Nicholson's New Carpenter's Guide* (1833), and used by Soane. However, Thomas Treadgold, *Elementary Principles of Carpentry* (1840, 80) poured ridicule on the idea of trussing:

> The methods in general adopted for that purpose have the appearance of much ingenuity; but in reality, they are of very little use. If the girder be trussed with oak, all the strength that can possibly be gained by such a truss consists merely in the difference between the compressibility of oak and fir, which is very small indeed; and unless the truss be extremely well fitted at the abutments, it would be much stronger without trussing.

Treadgold (1840, 81) goes further to describe experiments carried out on trussed beams, and comment on the methods proposed by earlier writers:

> The attempt to make a solid beam stronger in the same bulk, without using a stronger material than the beam itself is made of, is ridiculous; yet such has been the aim of most of these writers.

Still he does not go so far as to suggest that the floor could not support its own weight, a more recent notion that contributed to its demise.

The stables and coach house

The stables and coach house at the west end of the River Terrace were planned for the Navy Treasurer's House, which was in the outer west wing of Somerset House. The ground floor level of the service road gave access to the water gate onto the Thames, with the Treasurer's cellars and coal shed on the west, and on the east side a two-bay stable yard, a coach house, and two bays of stables; the horses were led round the portico at the south front of the building. On the floor above (the servants' floor and kitchen of the main house) there was no connection across the yard or the water gate, but there was a room over the coach house with two beds for the stablemen and an adjacent hay room, both reached from a stair in the stable (Chambers' designs at Sir John Soane Museum, 41/4/56-70). The 'final plans' of Somerset House do, however, seem to show rooms across the water gate (a pantry and larder), with a larger room above the coach house (now 'Secretary Navy Kitchen'), and beyond this to the east a large 'Repository for Navy Books' over the stables and Bargehouse (*ibid*, Nos 41/1/10-11). There was almost no trace of any of these arrangements remaining in the building, except for the indication of a fireplace found beneath the floorboards above the coach house. The hearth support took the form of an arch of bricks laid on their sides running between two floor joists, and supporting a layer of mortar and brickwork. In this bay of the floor there are five rather than six common joists, the central one being a close-set pair with a diagonal trimmer next to the hearth bricks, and two subsidiary joists flanking the hearth. This entirely conforms with the situation shown on the 1832 plan where the coach house has been divided into two with a corner fireplace in the north-west corner of the south room on both ground and first floor (PRO WORK30/277 and 279). Since the trimmers for the hearth appear to be of primary construction this suggests that the 'final plans' do not actually represent what was built.

Later alterations

The successive changes from Navy to Stamp and Inland Revenue offices in the River Terrace during the 18th century required a revised access and room layout (Inskip & Jenkins 1997, 21–6). Alterations were made at the western end of the mezzanine floor, with the formation of a bridge across the water gate entrance by Pennethorne in 1852–55, and even if these areas had been partly floored they were now renewed. All the western bays have a simple floor of principal joists running east–west and common joists running north–south, of no special interest (though with some reused timbers). Later uses of the mezzanine office were reflected in the wear patterns on the floor; clearly to be seen were the heavily used walkways round 'islands' where large desks or machinery had been located. These changes continued into the 20th century under different uses, with the most notable change being the introduction of steel support to the floors. In the eastern end of the building (and the two bays west of the Great Arch) the conversion of the Stamp Office to the Record Store in the 1870s (and the removal of the racking prior to the investigations) had left little evidence except doors and stairways to the former mezzanine floors. A series of steel joist floor reinforcements (and more tie bars to the vault) in the west part resulted from the removal of walls in the 19th and 20th century, and the introduction of embossing and printing machinery.

The South Wing

The initial design

The character of Chambers' design for the South Wing of the courtyard, and in particular the hierarchy of design and fittings between the floors, has been described in the Conservation Plan (Inskip & Jenkins 1997, 75–82). The majority of the recent works subject to the watching brief were in the lower levels, and the South Wing was built with deep two-storey basements, with narrow lightwells both at the front towards the courtyard and at the rear towards the River Terrace. There was thus a fairly elaborate provision for borrowed lights with windows between the rooms and the central corridors.

Two features of note were revealed in the strengthening of floors and creation of lift-shafts. While the primary floor construction, where surviving, was generally similar to that in the River Terrace (though without trussed girders because of the lesser span), there was the curious feature of the corridor at mid-basement level being alternately spanned by the principal joists from the front and the back of the building. This was achieved by taking the large principal joists from the front or back through a hole in the wall and across to the other side of the corridor (but never across the whole building). This can only have been achieved when the building had reached that level, and is slightly curious in that the lower passage was brick vaulted, and a floor could easily have been constructed without bringing in the principal.

The floors of the lift shaft just east of the central hall were investigated and found to be of the same general character as elsewhere, with three secondary joists running east–west between the principal and the brick wall, carrying the double system of common floor and ceiling joists. The central secondary joist was truncated by the trimmer for the hearth in the west wall, and this was carried on the two outer secondary joists, with the two flanking joists round the hearth being tusked through the trimmer and pegged in the usual manner for hearths. The hearthstone itself rested on a layer of plaster and winkle shells (presumably overlying a brick arch), perhaps intended as a heat-resistant layer.

Later alterations

The South Wing underwent a series of changes of use of the spaces by the Salt, Stamp and Navy Offices, Inland Revenue, and Probate Registry. Observations on the historic modifications to access and the arrangements of doors and windows, and the recent alterations have been recorded systematically, but do not significantly alter the existing account of the building or the information derived from historic plans. One of the less obvious features was the provision in the Second World War of safe ceilings in the basement levels, including concrete and timber vaults, presumably to protect the lower floors against collapse above. Some bomb damage in the south-west corner had been repaired by extensive rebuilding, and some of the surrounding floors at ground (courtyard) level were found to have been replaced with concrete.

SOMERSET HOUSE: THE EXCAVATIONS

Investigations in both the South Wing and the River Terrace revealed details of the construction of the current building, including a system of culverts running below the floor and a series of relieving arches in the River Terrace. They also provided details of its original uses, notably relating to the form of the Royal Bargehouse.

The construction of the South Wing

No construction cuts for the walls of the South Wing were identified, confirming that they had been built from a substantially lower level. The deposits beneath the existing floors were typically thick homogeneous layers consistent with a phase of large-scale backfilling during the erection of Somerset House. The presence of fragmented 16th- and 17th-century pottery and building material in the backfill suggests, not surprisingly, that deposits relating to Somerset Palace had been truncated to a significant degree by Chambers' construction. This was also evidenced in the western lightwell where Tudor masonry from the riverside wall had been reused to form part of the foundations for the south wall of the South Wing.

The construction of the River Terrace

The current conversion of the River Terrace involved removing all of the backfill deposited by Chambers following his initial construction of the foundations. The construction cut for the River Terrace was identified at a level of *c.*-

0.3m OD, cutting *in situ* foreshore deposits. The construction cut ran parallel to the River Terrace wall and was 0.3m wide. It could not be excavated as it exceeded remediation depth. Because of the paucity of finds, the surviving foreshore deposits into which it was cut cannot be reliably dated. Although 15th- and 16th-century wares were found, the majority of the assemblage from these deposits dates to the late 17th and early 18th century.

The culverts

A complex system of narrow culverts was revealed running at varying levels below the current floors (Fig 8). No construction cuts for these culverts were identified, suggesting that they were contemporary with the original building. They were all built from unfrogged red bricks (220mm x 100mm x 65mm) and were consistently flat bottomed with vertical sides and a vaulted top with an internal diameter of 0.4m. They were routed into two similarly formed but larger trunk culverts over 1.7m wide and 1.6m deep. These trunk culverts lay on a lattice of softwood planks infilled with red unfrogged bricks (220mm x 100mm x 65mm). All the planks were of similar dimensions: 0.34m wide, 0.12m thick and *c.*3m long. The main culverts cut the Tudor riverside wall, extending through the eastern and western lightwells into the River Terrace, and discharged into the main sewerage system beneath the Victoria Embankment.

The relieving arches

Spanning the River Terrace were a series of well-constructed north–south aligned relieving arches. These arches were constructed of unfrogged red bricks (220mm x 100mm x 65mm) on each pier of the Terrace outside the area of the Bargehouse (Fig 8). Each arch was 0.48m thick and constructed in English Bond. They were built into predesigned recesses in each of the piers and were sprung from varying levels. Only ten courses of each arch were keyed into the Terrace wall, the remaining courses simply butting against individual piers. This gave the impression that the River Terrace had been designed as a framework allowing for future changes in form and use.

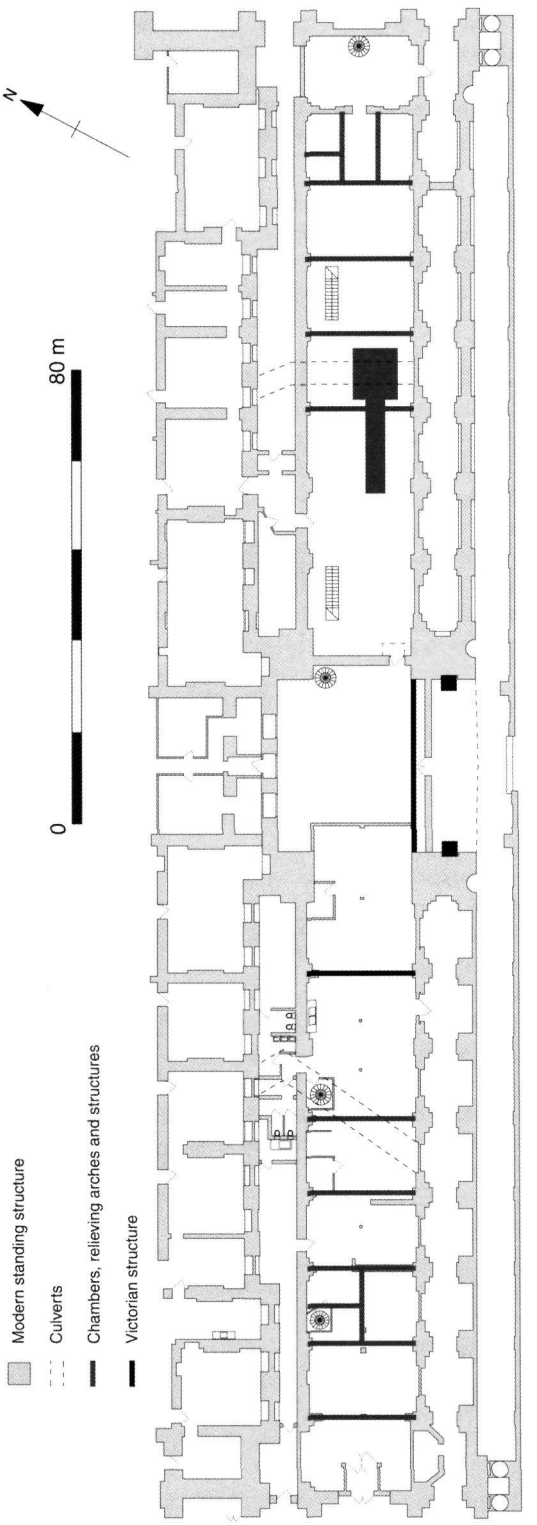

Fig 8. Culverts, relieving arches, and Victorian structures in the River Terrace

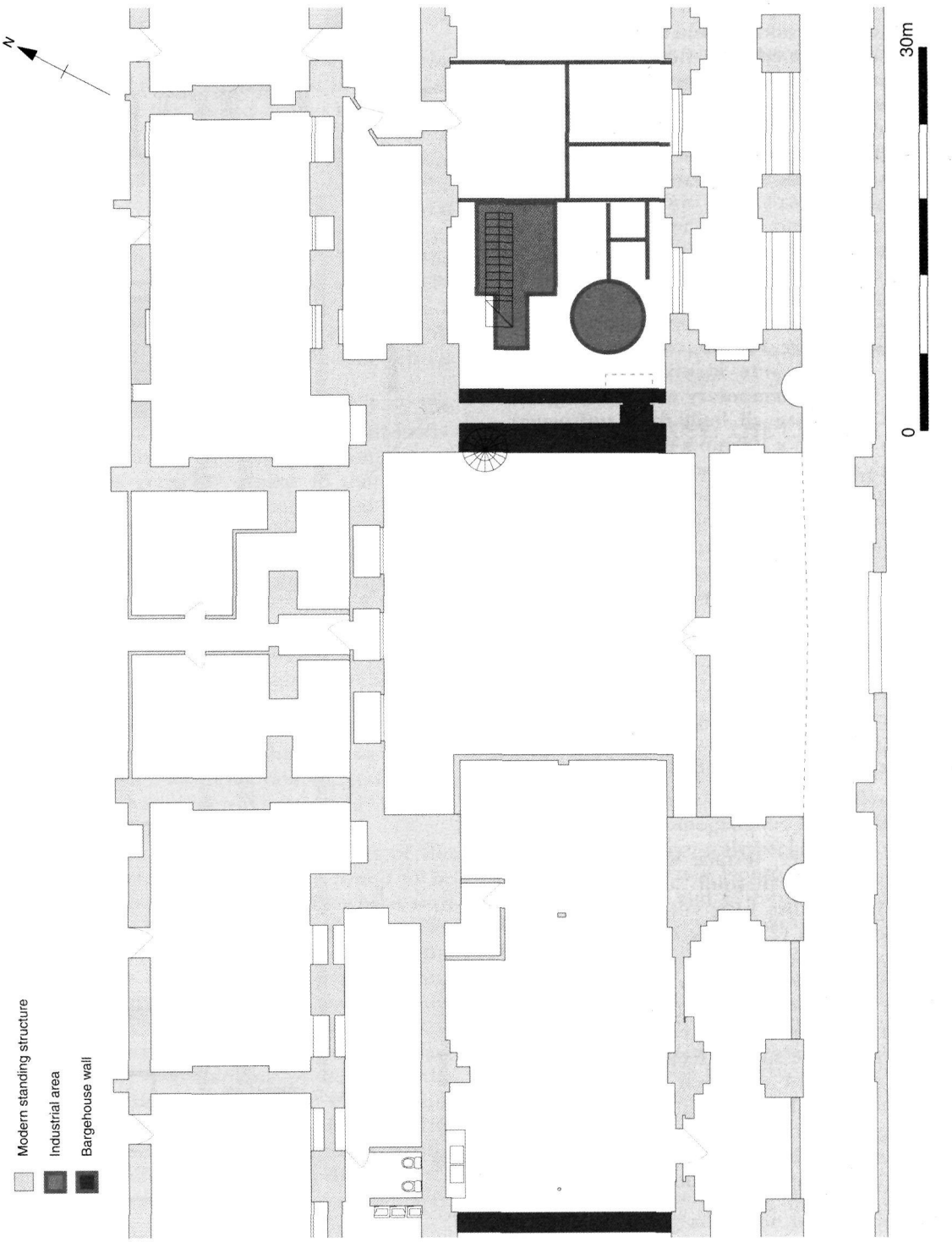

Fig 9. Location of the original Bargehouse walls and the industrial complex

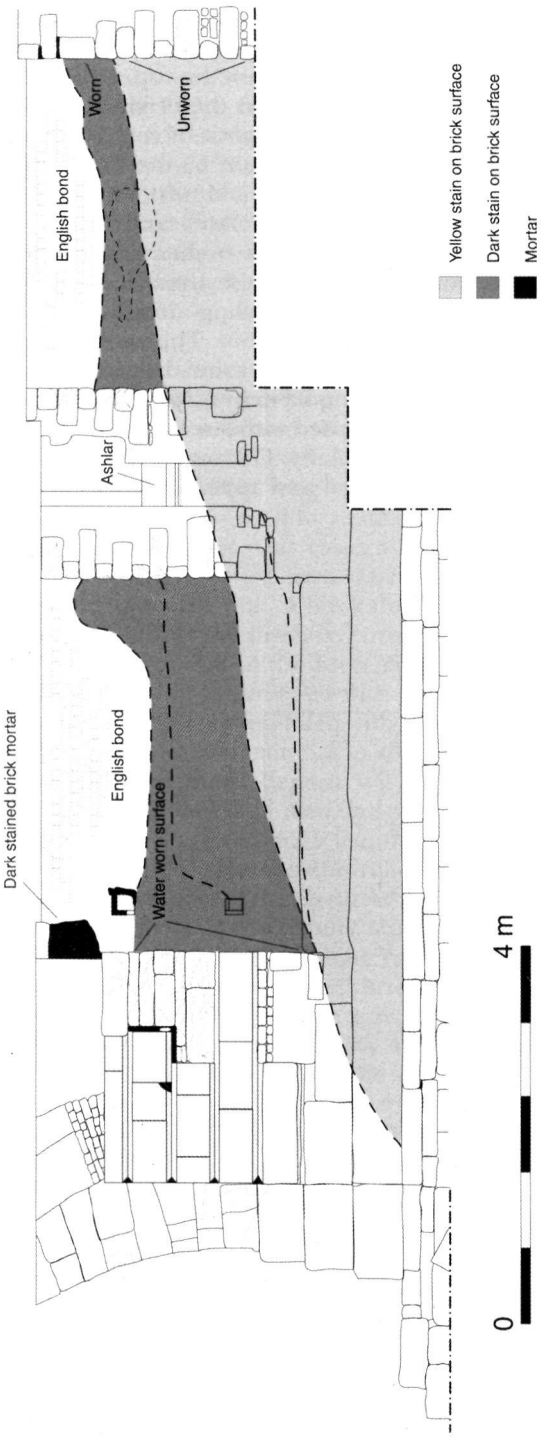

Fig 10. Evidence for the Bargehouse slipway

The Bargehouse

Excavation within the River Terrace revealed a number of features — the original walls and floor, and evidence for a slipway — relating to the original use of part of this structure as a Bargehouse.

The Bargehouse walls

Two red brick walls were revealed which defined the original extent of the Bargehouse along the River Terrace (Fig 9). The western of these two walls was located two piers west of the Great Arch. It was constructed in English Bond and founded at a level of 1.85m OD, substantially higher than the relieving arches. It stood 2m high and was 0.44m thick. The eastern wall was a more substantial construction and was located on the first pier east of the Great Arch. It was supported by a softwood timber raft consisting of east–west timbers, 0.34m wide and 0.16m thick, set 0.96m apart, overlain by north–south aligned timbers which were retained by a line of limestone blocks to the west. The wall itself was 0.94m thick at the top but battered offsets on each face widened the wall to a width of 2.0m at the base.

The western face of the eastern Bargehouse wall was pierced by four slots. Each of these slots was set within a recess in the wall, and was bordered by square raised brick surrounds 0.48m wide. Each slot was formed from a roughly rendered square of four stretchers, which were probably originally overflows which had subsequently been blocked. The depth of the slots increased from north to south, the eastern face of each sloping away at an angle of 85°. They emptied into a sloping drain in the wall's western face. This drain ran beyond the length of the wall and through the east side of the Great Arch, presumably towards the Thames. It was keyed into the superstructure of the Bargehouse wall indicating that it was an original feature and not a latter addition.

The slipway and floor

Examination of the wall of the River Terrace to the west of the Great Arch revealed a pattern of differential wear on the brickwork (Fig 10). The brickwork at the base of the wall remained unworn in comparison to the partially eroded bricks above. The wear pattern sloped upwards at an angle of 30° from the base of the Great Arch to the western wall of the Bargehouse. The pottery sherds recovered from the deposits which lay against the unworn brickwork were

exclusively 18th-century wares, in contrast to the mixed assemblage above which lay against the weathered brickwork. This pattern of wear marks the original location of the sloping slipway which ran from the Bargehouse down to the river.

Excavation below the Great Arch revealed a tiled surface which was interpreted as the original Bargehouse floor. No *in situ* silts dating from the lifespan of the Bargehouse were identified. Victorian deposits, dating from the time of the construction of the Victoria Embankment, lay immediately upon the Bargehouse floor (see below).

The industrial complex (Figs 9 and 11)

A wall on the first pier east of the water gate arch defined the edge of an industrial complex, perhaps related to a pump, which lay adjacent to the Bargehouse and whose presence was not indicated on any historic plans. This wall, constructed from unfrogged red bricks set with lime mortar in English Bond, spanned the River Terrace and was 0.44m thick. It was stained with a carbon deposit 1.8m from the top. Filling the area between this wall and the original eastern Bargehouse wall was a deposit of compact blue-grey clay which was overlain by the first of two York Stone slab floors. This, in turn, was overlain by a deposit of red-brown clayey-sand which had the appearance of being scorched and was oily to the touch. A layer of tiles had been placed over this sand as a levelling deposit for the second York Stone slab floor. This second floor appeared to have suffered some damage: a small area of it measuring 0.6m by 0.56m was missing, and had been patched with a series of red bricks measuring 240mm by 110mm by 70mm. The bricks were frogged and appeared to have been burnt.

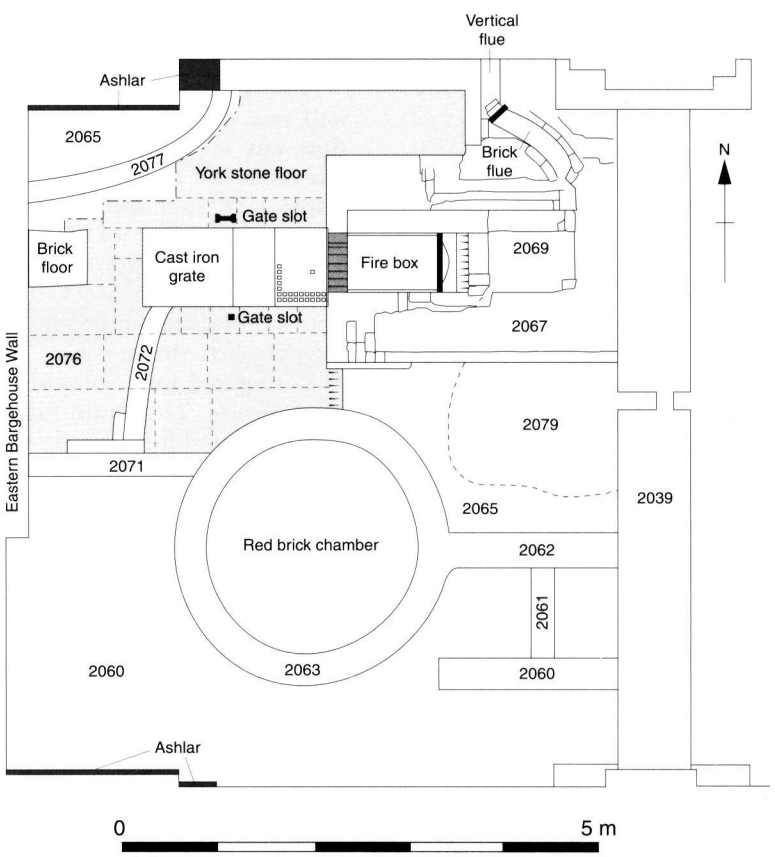

Fig 11. Plan of the industrial area

This slab floor had been constructed butting against two structures (Fig 11). One of these was a circular red-brick chamber with an external diameter of 2.92m and an internal diameter of 2.19m. It was over 4m deep, descending vertically for the first 1.90m then tapering in at an angle of 20° for 0.90m, before descending vertically again. It was rendered on both the interior and exterior faces with a 0.03m thick layer of mortar which showed evidence of burning and patches of heat cracking. A series of iron bands placed vertically against the exterior face were wholly contained within this render, presumably for reinforcement.

The second structure was a red-brick furnace box set within the slab floor 1.0m to the north of the circular structure (Fig 11). It had been constructed from the level of the first York Stone floor, and was 3.06m long and 2.96m wide. Its western half was covered by a cast iron grate split into three sections, the eastern end of which butted against a brick arch 0.62m wide which opened into a fire box. A brick flue led from the northern face of the fire box, curving north-west, into the north wall of the River Terrace. The inside of this flue was covered with a thick carbon deposit, and its base was filled with two deposits of burnt coal and ashy material to a depth of 0.5m. Overlying the burnt deposit was a 0.52m-thick deposit of ash, building materials, and mortar.

A further, large red-brick feature, constructed in two sections, spanned the relieving arch for the third pier east of the Great Arch (Fig 9). The first component of this feature was a rectangular structure, measuring 7.2m by 1.7m, constructed from seven courses of red brick (210mm x 100mm x 70mm) overlying a York Stone slab. The other component, a 3m by 4m rectangular red-brick foundation, lay to the east of the relieving arch. It was constructed primarily in English Bond (nine courses) with two irregular courses. Both features were constructed to the level of the relieving arch. Overlying both of these structures and the relieving arch was a mortar and tile 'sandwich' which formed a hard rendered surface. Within the mortar and tile surface were five recesses measuring 0.48m by 0.24m. They had been formed solely from the tile and mortar render and did not extend into the brick foundations. They may have been intended to hold timber uprights.

Excavation of the most easterly bay within the River Terrace revealed two east–west aligned red-brick walls, both constructed from unfrogged red bricks (210mm x 105mm x 65mm) in English Bond. They may have been floor supports.

THE VICTORIA EMBANKMENT

Excavation within the River Terrace revealed a number of ways in which this building had been affected by the construction of the Victoria Embankment by Bazalgette between 1864 and 1870. It ended the use of the Great Arch as a water gate, the Bargehouse was filled up to the present ground level, and a number of other features were constructed within and around it.

The filling of the Bargehouse

During the construction of the Victoria Embankment, the Bargehouse was filled up to the present ground level. The excavation of the water gate revealed several dumps of Victorian deposits overlying the tiled floor of the Great Arch. Overlying these first Victorian dumps lay numerous deposits, usually consisting of fine lenses of waterborne sands and silts, containing 18th- and 19th-century artefacts. If the infilling of the Bargehouse for the construction of the Victoria Embankment was not the result of a single episode of activity, but took place over an extended period, then these lenses could be the result of periodic flooding of the Thames. Such flooding could explain the redeposition of 18th-century assemblages in securely dated Victorian contexts.

Victorian brick structures

The excavation also identified a series of Victorian yellow stock brick structures within the Bargehouse (Fig 8). A brick built square pillar was constructed against each face of the Great Arch. These pillars extended beneath the initial level of impact of the renovation works. Their insertion had removed any 18th-century silts at the entrance of the Bargehouse. Two relieving arches were also constructed across the face of the Great Arch, and a fifth structure, taking the form of a crudely constructed relieving arch, was identified to the west of the Great Arch. Unlike the 18th-century arches this later addition was not aligned with the north–south piers, nor was it keyed into the main building, suggesting it had been constructed as a temporary measure during the backfilling of the Bargehouse at the time of the construction of the Victoria Embankment.

Two pier bases constructed in brick with Portland Limestone slab foundations were found in the area to the west of the water gate. These structures were of similar dimensions, being 0.69m wide, 0.69m thick, and of 1.56m and 1.73m high. Both structures were identified at *c.*2.10m OD.

THE FINDS

The pottery

Duncan H Brown and Robert Thomson

Introduction and methodology

A total of 190 sherds of pottery, weighing a total of 7,947g, was recovered during the excavations and building survey. The pottery in every context was sorted into ware, sherd, and vessel types, and quantified by weight and sherd count. The approximate date of manufacture of each ware type was recorded with additional comments relating to glaze type, origin, and sherd condition. Specific fabric types have not been identified, the pottery instead being simply divided into ware types or traditions which represent groups of products. This level of recording was considered sufficient for an assemblage which is largely 19th-century in date and essentially too small to reward more detailed analysis.

Chronology and context

For the purposes of this report the pottery has been divided into the following three chronological groups:

Group 1 consists of pottery, mostly dating to the 19th century (but including also some earlier material), which was found in contexts contemporary with and post-dating the original construction of Somerset House. These included contexts associated with the partial demolition of the Tudor river wall, the original backfill of Chambers' foundations, deposits underlying floors (usually replacement rather than original floors) throughout the building, and the fill of the River Terrace associated with the construction of the Victoria Embankment.

Group 2 consists of pottery, mostly of 17th-century date (but including also some earlier and later sherds), from foreshore deposits which built up against, and thus post-date, the construction of the Tudor river wall, but which predate the construction of Somerset House.

Group 3 consists of pottery of 16th- and 17th-century date which comes from contexts associated with the Tudor garden and which thus also post-dates the construction of the Tudor river wall. A single sherd of Surrey White Ware, dating from the 15th century, from a layer of alluvial silt which appeared to be cut by the Tudor river wall, was the only pottery found in a context earlier than the river wall.

The character of the assemblage

Group 1

Group 1 contexts produced 85% (by weight) of the entire assemblage of pottery, and 95% of that is 19th- or 20th-century in date, the rest being composed partly of residual pottery and partly of pottery from genuinely earlier contexts (Table 1).

The only sherd from the deposits below floors which is not 19th-century or later in date was a single sherd of Raeren stoneware, dating from the 15th or 16th century, which is likely to be residual. Several fragments from these contexts have been burnt at very high temperatures and appear similar to pottery from Southampton and Coventry which was burnt in the Blitz of 1940.

The pottery from the layers filling the River Terrace is mostly of 18th- and 19th-century date. The presence of earlier types of pottery, such as post-medieval redware, post-medieval French ware, and Chinese porcelain indicates the kind of mixing which is to be expected from backfill.

The sherds from the layers overlying the Tudor wall, probably deriving from its partial demolition and the backfilling of Chambers' foundations, date from the 17th and 18th centuries, although one sherd with mortar adhering to it is earlier in date, perhaps 16th-century, and may be residual, originally having been associated with the Tudor river wall.

Overall the pottery in these contexts is typical of the types of pottery in use in London in the periods represented. The most common type is refined earthenware from the Staffordshire factories. This material is badly fragmented and no patent marks are present. The range of vessels — bowls, cups, chamber pots, dishes, plates, and turreens — is typical of a domestic assemblage.

English stoneware, including Doulton and other types, occurs in large fragments from storage jars, bottles, and a water filter. There are two almost complete blacking or ink bottles. Among the earthenwares are fragments of flower pots, again suggesting a domestic origin.

Group 2

All of the pottery from the foreshore deposits lying against the Tudor wall, amounting to 12% by weight of the whole assemblage, dates from the 18th century or earlier (Table 1). This pottery, too, is largely domestic in character, although the small quantities involved do not permit any very specific interpretation. Alongside the more numerous English wares are types from France, the Rhineland, the Iberian peninsula, and China. All of these are typical imports of the period and are common finds in London. The Chinese porcelain is the only indication of the social standing or wealth one might expect to be associated with the site.

Group 3

The material forming Group 3 consists mainly of English wares as well as Low Countries redware and Frechen stoneware, and dates mostly from the 16th and 17th centuries (Table 1). These latter two types are typical imports of the period. The quantity of pottery from these contexts is too small to allow any further interpretation.

The clay tobacco pipes

D A Higgins

Introduction

A total of 48 fragments of clay tobacco pipe, comprising 6 bowl and 42 stem fragments, was recovered from both the foreshore deposits predating the 18th-century construction of Somerset House and from later 18th- and 19th-century deposits within the building.

All the pipes have been individually examined and catalogued using the draft recording system developed at the University of Liverpool (Higgins & Davey 1994), a copy of which has been deposited as a part of the site archive. The bowl forms referred to are taken from the London typology published by Atkinson and Oswald (1969). The pipes from the two groups of deposits are discussed separately below.

The foreshore deposits

The largest and most interesting group of pipes, consisting of 3 bowl and 20 stem fragments, was

Table 1. Quantification of pottery by date and period group (figures in parenthesis are percentages of overall totals)

	Pottery date	Weight (g)	Weight as %Phase	Sherd count	Sherd count as % Phase
Group 1	15C	22	<1	1	1
	16C	14	<1	1	1
	17C	118	2	10	7
	18C	217	3	20	14
	19C	3410	51	106	72
	20C	2962	44	9	6
Total		6743	(85)	147	(77)
Group 2	16C	67	7	4	11
	17C	377	38	9	26
	18C	554	55	22	63
Total		998	(12)	35	(18)
Group 3	15C	3	1	1	12.5
	16C	134	65	5	62.5
	17C	51	25	1	12.5
	18C	18	9	1	12.5
Total		206	(3)	8	(4)
Overall Total		7947		190	

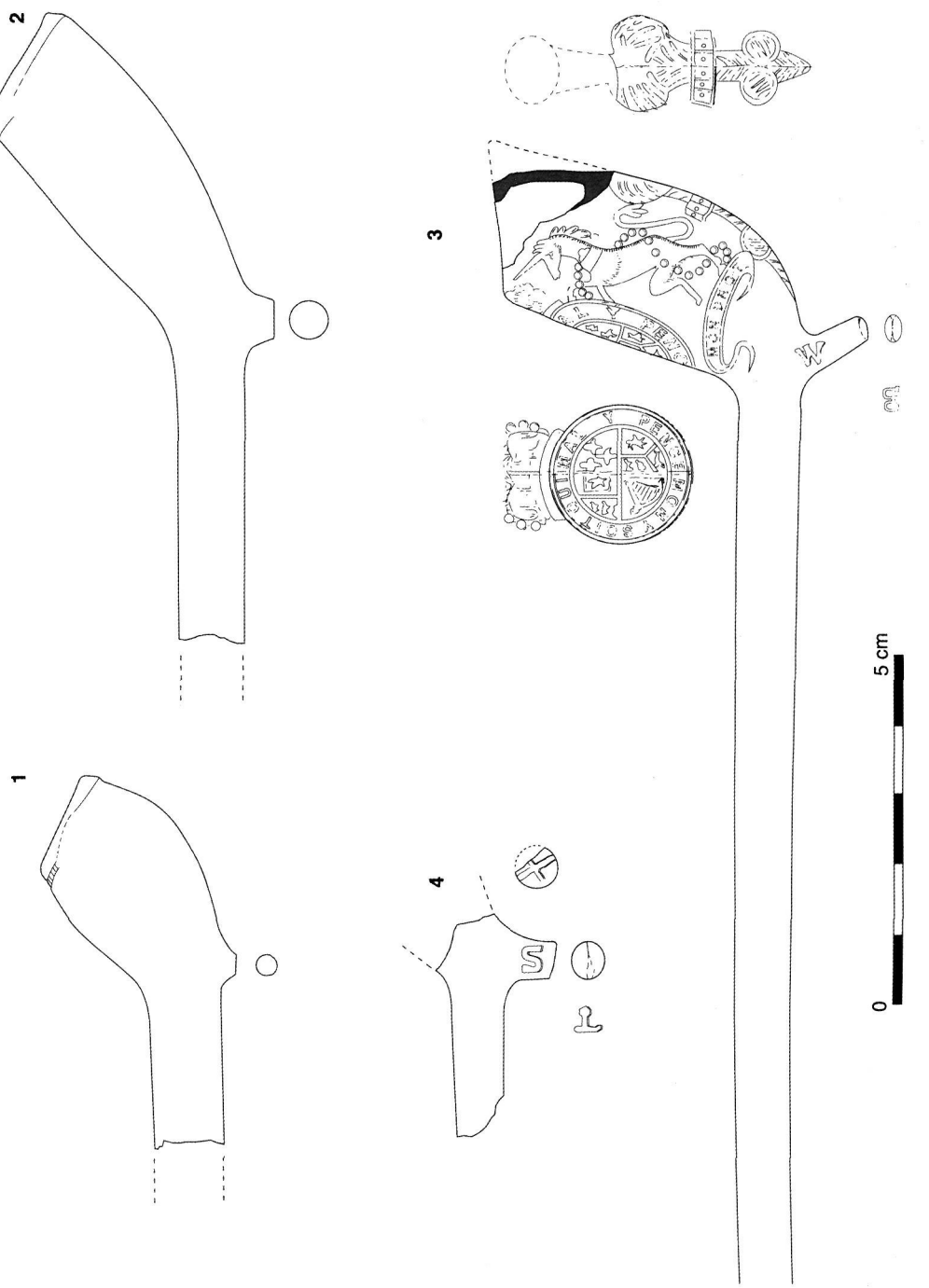

Fig 12. Clay pipes (Drawn by P Lorimer and S Cheshire, after Higgins)

recovered from the foreshore deposits lying against the Tudor river wall and predating Somerset House. The earliest element of this group comprises 1 bowl and 11 stems which can be dated to the late 16th or 17th century.

The only bowl recovered from this early group is a London type 9 variant, which dates from *c.*1640–60 (Fig 12.1). This is rather a poor quality product with a lop-sided form and only one quarter of its rim milled. In contrast, four of the eleven stems, over one third, are burnished. Two of these pieces, one of which is of a type that could be as early as the late 16th century in date, are finely burnished while the other two have a good burnish. Burnished pipes were more expensive and a higher quality product than unburnished pipes. In London burnished pipes normally represent only a small percentage of those recovered, and so this marked concentration is particularly unusual. Although the sample size is too small to draw any firm conclusions, it may be that this early group represents the consumption and disposal of high quality goods at Somerset Palace.

The remaining pieces from the foreshore deposits worthy of note are a typical plain London form of *c.*1690–1710 (London type 20 variant; Fig 12.2), and an armorial bowl with three joining stem fragments. This piece stands out from the rest of the group as being both the latest and most complete pipe present.

The armorial bowl is a London type 26 spur pipe, one of the less common London forms (Fig 12.3). It is mould decorated in relief with the Hanoverian Arms facing the smoker and with the Prince of Wales feathers on the seam facing away from the smoker. The precise detail of this pipe cannot be matched with any published example, nor do the maker's initials, 'BW', appear to have been previously recorded on an armorial pipe. There is no known London maker with these initials (Oswald 1975); thus this pipe appears to represent both a new mould type and a previously unrecorded maker, although quite a number of London armorial pipes with the initials 'WB' are known and this example may have come from the same workshop with the initials having been reversed in error.

The other interesting point about this example is the amount of stem that survives. The joining fragments give a total of 210mm of surviving stem, which is still 6.5mm in diameter at its broken end. The only other substantially complete comparable example comes from Paul's Wharf where a pipe with 280mm of surviving stem has been recorded (Le Cheminant 1981, fig 3.7). Neither of these pipes appears to be broken very near the mouthpiece and so it seems likely that they would both have been considerably longer originally. The more common types of complete contemporary pipe had stems in the 270mm to 380mm range (Higgins 1987, 64). The projected length of the armorial pipes would at least have equalled the longest of these. The length of the armorial pipes is significant since the longer the stem of a pipe, the more it cost to produce. When combined with the cost of producing the elaborate moulds it seems likely that these would have been expensive items.

The Somerset House stem is also interesting because it is very slightly curved. Until towards the end of the 18th century all English pipes had straight stems (Fig 12.3 inset). The reasons for and precise date of the change to curved stems are not known, but the origins of the practice may be evident in this example: perhaps curved stems were initially introduced on the long stemmed and elaborately decorated armorial pipes, the fashion later moving down to the cheaper varieties.

Although it is safe to say that armorial pipes were not very common, and that they represent a distinctive and probably expensive form of pipe, very little is known about how they were perceived in contemporary society. Examples have been recovered from a wide range of sites, including a number of royal sites such as the Tower of London and Hampton Court Palace, and colonial sites such as Williamsburg, Virginia.

In terms of dating, the majority of armorial pipes show the Hanoverian Arms that were adopted in 1714 (Noël Hume 1970, 142) and, from the 1740s (Atkinson & Oswald 1980, 363), became one of the first designs to be regularly moulded on pipe bowls in London. In 1980 only nine dated deposits from which armorial pipes had been recovered could be listed (*ibid,* 364). The general form of the Somerset House example dates from *c.*1740–80, although the thin stem and bowl walls suggest it probably dates from towards the end of this period. This is significant given that the context in which it was found was sealed by the construction of Somerset House in 1775, thus providing a *terminus ante quem* for the pipe. In addition, the pipe appears to have been freshly deposited, since it was found with three joining stem

fragments. For these reasons it seems likely that this example can be closely dated to around 1775 which, in turn, provides an important fixed point in the typology and evolution of this interesting class of pipe.

The Somerset House deposits

The most significant fragments from the deposits associated with Somerset House itself are from two bowls, both of which can be dated to the late 18th or 19th century. One appears to be part of a London type 28 dating from *c.*1820–60, and the other is part of a London type 27 bowl of *c.*1780–1820 with the maker's initials 'TS' moulded on the sides of the heel, and an internal bowl cross, which is shown as a plan detail in the drawing (Fig 12.4). Internal bowl crosses are relief marks formed by the metal stopper that was used to create the bowl cavity during the manufacturing process. They occur occasionally on 18th- and 19th-century pipes, but their purpose is not clear. The only documented London maker with the initials 'TS' recorded during the relevant period is Thomas Scourfield of Whitechapel, who worked from 1805 to 1839 (Oswald 1975, 146). The London list is not, however, particularly reliable and so this attribution and dating has to be viewed accordingly. If the dates attributed to both of these pipes are correct, then the context from which they came, the make-up for the floor of one of the rooms in the South Wing, would seem to date from around 1820 when both of these forms might have been in use, post-dating the main construction of the house. Several other pieces of thin, round stem which are likely to post-date the initial construction of the building were also found, though in general it is perhaps surprising how many residual pieces were recovered from deposits connected with the building.

Conclusions

Although this is only a small assemblage the pipe evidence suggests that high status rubbish from the palace was being discarded directly into the river during the 17th century. The later pipes are generally undistinguished, although an interesting and closely datable armorial pipe has been recovered. This is a previously unrecorded type and provides important information about the form and evolution of this particular style. The later groups reflect the construction and subsequent refurbishment of Somerset House, with some residual material being present.

The hair curler

D A Higgins

A single fragment of a ceramic hair curler, used to curl the hair on wigs, was found below one of the floors in the South Wing. The curler has been broken in half and the whole of the end, which might have had a maker's mark, has also been chipped away. Sufficient survives, however, to show that this was part of a smooth, symmetrical 'dumb-bell' curler of 18th-century type.

Although wigs are known to have been worn during the late 16th and early 17th centuries, it was not until the Restoration that they became fashionable in this country. From around 1660 until the end of the 18th century they remained very popular, and almost all of the hair curlers found date from this period. 17th-century curlers tend to have rather wide, flat ends and, sometimes, a central perforation (Le Cheminant 1982, figs 1–7). After 1700 a much more uniform dumb-bell shape with rounded ends and no perforation appeared (*ibid*, figs 8–18). The clay pipes found in the same context as the curler include diagnostic pieces ranging from *c.*1780 to 1860 in date, and are mostly likely to have been deposited around 1820 (see above, 'The clay tobacco pipes').

Building materials

Kate Atherton

A total of 94 pieces (*c.*211kg) of building material was recovered, comprising brick, roof tile, curved roof ridge tiles, a possible roof finial, drain fragments, plaster or mortar, and a modern glazed wall tile. These range in date from the early post-medieval or Tudor period through to the 19th or 20th century; much of the material could be Tudor. A database of all of the building materials, containing full catalogue details as well as an analysis of their fabrics, has been deposited with the site archive.

Little can be concluded about the individual components of this small assemblage. The most notable aspect is the absence of floor tiles, the predominance of roof tiles, and the small amount of brick. The pieces are generally small and worn and some fragments show burning

on fractures. These factors suggest that the assemblage probably derives in large part from demolition prior to the construction of Somerset House in 1775.

The metal artefacts

Ian Scott

Introduction and methodology

A small assemblage comprising 36 iron and 5 non-ferrous objects was found during the excavations, mostly in contexts related to the industrial complex but also from other contexts such as those below the floors, and making up the foundations of Somerset House. The finds were quantified and recorded with context and other references, measurements as appropriate, and written descriptions. Objects were identified to broad functional categories using the system being developed by the OAU for finds assessment and analysis.

The artefacts

A large part of the assemblage of metal artefacts, comprising 13 of the iron objects, including many of the larger pieces, was found in the industrial complex, in the circular brick structure and its fills, the brick flue, and a deposit containing residues from the complex. They include a complete fire shovel, fragments of a second shovel and a fire rake, as well as a cast iron slotted fitting probably for a gate or similar object. These objects were found together with an L-shaped holdfast, a large nail or pin, and a bolt. In addition, there was a length of wire hawser, two lengths of pipe, and some rectangular-sectioned strips.

The remaining 23 iron objects comprise 19 nails, a threaded bolt, a spike with a threaded lug — all found below the floors of Somerset House — and a length of rectangular-sectioned bar found in deposits below the Great Arch. Most interesting is a mooring ring found in demolition rubble overlying the Tudor river wall.

The non-ferrous objects comprise a piece of badly corroded aluminium edging of recent date, three fragments of sheet of irregular outline in an unidentified non-ferrous metal, and a rectangular-sectioned strip of copper alloy with at least two nail holes, all found in deposits below the Great Arch.

Discussion

The complete fire or stoking shovel is large and was clearly for use with a large furnace or fire. The incomplete shovel probably had a handle of similar length, although its blade is smaller and appears to narrow towards the mouth. The rake lacks much of its handle but presumably also had a long handle comparable in length to that of the complete shovel. The other interesting object is the cast iron slotted fitting. The fact that there are no fixing holes in the surviving portion of this rectangular plate suggests that it formed the base plate of a larger object and that it was built into a structure, probably of brick. It seems most likely that it was a shutter for a fire box. There were probably originally two slotted arms rising from the base plate; the slots would have been facing and could have held a sliding plate to act as a shutter.

The glass

Cecily Cropper

An assemblage of 97 fragments of glass was found during the excavations. Almost all of this consisted of 19th- and 20th-century window and bottle glass. The earliest fragments of window glass, however, probably dating from the 17th century, were found in secondary deposits that may originally have been associated with Somerset Palace. This glass could represent the last (plain) glazing associated with the palace.

The worked stone

Julian Munby

Five pieces of worked stone, including two large slabs of white marble with smoothed upper faces, were retained from the building survey and excavation. Two pieces of moulded architectural stonework were also recovered during the excavation. One of these, of fine white limestone, was a cornice fragment with a cyma moulding which probably dates from the 17th/18th century. The second, of fine creamy white limestone, formed part of the base of a fluted column which is attributed to the 16th/17th century. It seems likely that both of these pieces derive from Somerset Palace though it is, of course, difficult to say from which part of that building.

The animal bone

Beth Charles

Introduction and methodology

A total of 48 fragments of bone were retrieved from the site, 13 fragments of which were from foreshore deposits predating Somerset House; the remainder were retrieved from beneath floor surfaces within Somerset House dating from the 18th century and later.

Almost all of the bone was very well preserved, as the preservation of smaller elements such as rabbit bones demonstrates. All of the bone from the contexts predating the 18th century and almost 70% of the bone from the later deposits was identified. Butchery marks, such as knife scratches and chop marks, could be clearly seen on many of the bones from both periods.

All fragments of bone were recorded including elements from the vertebral centrum, ribs, long bone shafts, and teeth. An attempt was made to separate sheep and goat bones but since no goat was positively identified all caprine bones are listed as sheep. Due to the absence of complete mandibles, age could be estimated only by examination of the rate of epiphyseal fusion (using a combination of Silver's (1969) and O'Connor's (1982) tables). Even then sheep bones dating from the 18th century onwards were the only elements surviving in sufficient quantities for estimates of age to be made.

Species representation

Sheep and cattle dominate the bone from both sets of deposits. Very little more can be said regarding the bone from the pre-18th-century deposits since only 13 fragments were found. A cattle metatarsal was of particular interest as it had been worked. It had been cut mid-shaft, the distal half only remaining. There was scoring along and across the bone and a circular hole down the centre of the shaft. The skeletal elements from the cattle and sheep indicated butchery waste, the majority being vertebrae, ribs, and feet bones. In addition, there were three fragments of cattle horncores.

The bone from the 18th- and post-18th-century deposits probably appears more varied than the earlier bone because of the larger quantity recovered. The majority of the bones from cattle and sheep appear to be butchery waste such as feet bones and ribs. There were also a few elements from dog, cat, and rabbit which are animals commonly found on sites dating from the post-medieval period. Three domestic fowl ulnas were also found in the later deposits.

Diagnostic elements from the sheep indicated that the majority were slaughtered after the age of two years. This relatively old age may reflect the greater importance of secondary products such as wool in the post-medieval period.

Discussion

The bones from both sets of deposits appear to be butchery waste. The assemblages give some indication of the variation in the diet of the site's inhabitants and neighbours but, given the small number of bones retrieved from both periods, it is difficult to assess how representative the surviving sample is.

THE ENVIRONMENTAL EVIDENCE

The macroscopic plant and mollusc remains

Mark Robinson

Introduction and methodology

Macroscopic plant and mollusc remains were analysed from samples of 100g taken from deposits predating the Tudor river wall which had been cut by its pile foundations (Samples 70–71) and from later deposits which had accumulated around its pile foundations (Samples 67–69). (Pollen from the same contexts was also analysed, see below.) The samples were sieved to 0.2mm and scanned under a binocular microscope at up to x20 magnification. The waterlogged seeds have been listed in Table 2 and the freshwater molluscs in Table 3. In addition, shell fragments of *Mytilus* or *Modiolus* sp. (marine mussel) were recorded from Samples 67, 69, 70, 71 and *Ostrea edulis* (marine oyster) was noted from Sample 67.

Interpretation

Shells of freshwater molluscs are well-preserved throughout the sequence of samples and are particularly abundant in the samples from the layer cut by the piles (Samples 71–70). They comprise a fauna of clean, flowing, fresh water. Most of the species, for example *Bithynia tentaculata* and *Pisidium amnicum*, do not tolerate stagnant or poorly oxygenated conditions.

One species of particular interest is *Gyraulus acronicus*, which in Britain is restricted to the Thames drainage system and no longer occurs as far downstream as London (Kerney 1976, 44). Whereas the freshwater mollusc shells were from species living in the Thames, the marine shells represent waste from food preparation which had been dumped in the Thames.

With the exception of a single seed from the emergent water plant *Apium nodiflorum* (fool's parsley), the waterlogged seeds are also all from species which were not living in the river. The occurrence of cereal bran and broken seed fragments of *Agrostemma githago* (corn cockle), a weed whose seeds were formerly common contaminants of flour, suggests one source was human sewage. The pips of *Fragaria vesca* (strawberry) and *Ficus carica* (fig) are also likely to have been derived from sewage. Various of the other seeds were probably from domestic or industrial refuse including *Humulus lupulus* (hop), possibly from brewing, *Cannabis sativa* (hemp), possibly from fibre processing or medicinal usage, and shell fragments from the edible nut *Juglans regia* (walnut). *Papaver somniferum* (opium poppy) and *Reseda luteola* (dyer's rocket, the source of a yellow dye) were both cultivated for economic purposes, although both readily grow on waste ground, so the origin of their seeds is uncertain. A *Calendula officinalis* (marigold) seed from Sample 69 is likely to have been from a garden plant grown either for ornamental or medicinal purposes. Otherwise the seeds were from weeds, such as *Chenopodium rubrum* gp (red goosefoot) and *Rumex* sp (dock), likely to have been growing on waste ground, or in some instances mud, along the river bank.

Taken together, this evidence suggests that the deposits are riverine silts which accumulated beneath fresh water which was kept reasonably well oxygenated by the flow of the river, despite an input of organic refuse including sewage.

Table 2. Waterlogged seeds

	Context	5319		5318		
	Sample	71	70	69	68	67
	Depth (cm)	50	40	30	20	10
Ranunculus cf *repens*	creeping buttercup	-	+	-	-	+
Papaver somniferum	opium poppy	-	-	+	-	-
Fumaria sp	fumitory	+	-	-	-	-
Reseda luteola	dyer's rocket	-	+	-	-	-
Agrostemma githago	corn cockle	-	+	+	-	+
Stellaria media gp	chickweed	-	-	-	-	+
Spergula arvensis	corn spurrey	-	-	-	-	+
Chenopodium album	fat hen	-	-	-	-	+
C. rubrum gp	red goosefoot	-	+	-	-	-
Atriplex sp	orache	-	-	+	+	-
Fragaria vesca	strawberry	-	-	-	-	+
Apium nodiflorum	fool's watercress	-	+	-	-	-
Polygonum aviculare agg	knotgrass	+	-	-	-	-
Rumex acetosella agg	sheep's sorrel	-	-	-	-	+
Rumex sp (not *acetosella*)	dock	+	+	-	-	-
Urtica dioica	stinging nettle	+	-	-	-	-
Ficus carica	fig	-	-	+	+	+
Humulus lupulus	hop	-	-	+	-	-
Cannabis sativa	hemp	-	+	-	-	-
Juglans regia	walnut	-	-	-	-	+
Sambucus nigra	elder	-	-	+	-	-
Calendula officinalis	marigold	-	-	+	-	-
Anthemis cotula	stinking mayweed	-	-	-	+	-
Cereal bran		-	-	+	-	-

+ present

Table 3. Mollusca

Context	5319		5318		
Sample	71	70	69	68	67
Depth (cm)	50	40	30	20	10
Theodoxus fluviatilis	+	+	+	+	-
Valvata piscinalis	++	++	++	+	+
Bithynia tentaculata	++	++	+	+	+
B. leachii	-	-	+	-	-
Bithynia sp	++	++	+	-	-
Lymnaea truncatula	+	-	-	-	-
L. peregra	+	+	+	+	-
Gyraulus acronicus	+	+	+	+	+
Unio sp	+	-	-	-	-
Sphaerium sp	-	+	-	-	-
Pisidium amnicum	+	+	+	+	+
Pisidium sp	+	+	+	+	+

+ some ++ many

The only chronological change in the sequence possibly of significance is that pips of *Ficus carica* (fig) are restricted to the upper deposit (Samples 69–67).

The pollen

Robert G Scaife

Introduction and methodology

Five samples taken from Tudor foreshore deposits at Somerset House have been examined for their sub-fossil pollen and spore content. The samples were taken at 10cm intervals from the same two deposits which were analysed for macroscopic plant and mollusc remains, one of which was cut by the foundations of the Tudor river wall and one of which had built up around the pile foundations.

Standard techniques were used for the extraction of the sub-fossil pollen and spores from the 2ml samples (Moore & Webb 1978; Moore *et al* 1991). Micromesh sieving was used to aid removal of the clay fraction from these predominantly minerogenic samples. Absolute pollen frequencies were calculated using added exotic (*Lycopodium*) markers to the known volume of sediment. Pollen was successfully extracted from all of the samples and was identified and counted using an Olympus biological research microscope fitted with Leitz optics. A pollen sum of 400 grains per level plus wetland types and spores was counted for each sample. Data are calculated as a percentage of total pollen excluding freshwater marsh/aquatic taxa, spores, and miscellaneous microfossils. The latter categories were calculated as a percentage of the principal pollen sum plus those taxa in the other categories. Plant taxonomy follows that of Stace (1991) and for pollen Moore and Webb (1978) modified according to Stace/*Flora Europaea* (Bennett *et al* 1994).

Results

There appears to be no real variation in the pollen/vegetation spectra from the two deposits sampled and they are, therefore, discussed together. There is a homogeneous but diverse range of pollen taxa and consequently no pollen zones have been defined. Overall, herbs are dominant (up to 85%) with relatively small values for trees and shrubs (average 15%). There are also small but consistent values for marsh/aquatic taxa and spores present.

Amongst the woodland types, *Quercus* (oak) (up to 15%) is most important, with sporadic records of *Betula* (birch), *Pinus* (pine), *Ulmus* (elm), *Tilia* (lime), *Fraxinus* (ash), *Carpinus* (hornbeam), *Fagus* (beech), *Juglans* (walnut), *Alnus* (alder), and *Taxus* (yew). Shrubs consist of *Corylus avellana* type (hazel) with occasional ericales. The small percentages of tree types indicate only the

background, regional woodland. *Tilia*, *Fraxinus*, and *Fagus* are usually poorly represented in pollen spectra and whilst these taxa may be representative of local and under-represented growth, it is more likely that their pollen were fluvially transported from some distance. *Juglans* (walnut) may be an exception, being generally regarded as a Roman introduction to western Europe and now frequently recorded on Roman and post-Roman sites in London.

A very diverse range of herbs is represented in the sequence, amongst which Poaceae (grasses) (up to 60%) are clearly dominant. The majority of taxa are weeds of waste and disturbed ground and agriculture, largely represented by sporadic occurrences of taxa including members of the Brassicaceae (*Sinapis* type: charlocks), Fabaceae (clovers and vetches), Plantaginaceae (plantains), Polygonaceae (*Polygonum* spp and *Rumex* spp), and Asteraceae (daisy family, including *Centaurea cyanus* (blue corn flower)). Cereal pollen comprises *Triticum/Hordeum* type (wheat and barley) (5%) and occasional *Secale cereale* (rye). There are also some taxa which suggest halophytic communities and thus the possibility of saline/brackish water and tidal influences. These include *Chenopodium* type (oraches, glasswort and goose-foots), *Armeria* 'A' line (thrift and sea lavender), and possibly large Poaceae (>45u with thin exine and small pores) from salt marsh grasses. Hystrichospheres are also present.

Such diversity of herbs is typical of medieval and later pollen assemblages from urban areas. Comparable data in London come from Broad Sanctuary, Westminster (Scaife 1982) and Parliament Square, Westminster (Branch 1989). The taphonomy is complex with pollen deriving from a number of sources through natural, airborne, and fluvial transport and from secondary, derived sources. The latter may typically include domestic refuse, floor sweepings and animal bedding, and in particular human and animal ordure. Such an array of sources may give rise to very diverse pollen assemblages (Greig 1981; 1982). Broad Sanctuary, Westminster clearly showed this with similarly high values of herb pollen including cereals and associated segetal weeds, whilst very substantial numbers of intestinal parasites (*Trichuris* and *Ascaris*) attest to the presence of pollen from animal offal and human and animal faecal material dumped into the Tyburn Stream channel at Thorney Island. At Somerset House, such parasites were not prevalent but were present. Since numerous London streams (Nunn 1983) were essentially open sewers draining into the Thames (Ziegler 1969, 159–60), the bulk of the pollen recovered here probably came from these sources. The exception to the above typical 'urban assemblages' is the small number of halophytes (*Chenopodium* type, *Armeria* type, and some Poaceae) which are indicative of brackish/tidal water. This is in accord with the results of the diatom analysis (see below).

Conclusions

A diverse range of pollen types has been recovered from these alluvial foreshore sediments. Tree pollen percentages are small but show a moderate diversity of types including walnut. Herbs are dominated by grasses but with a diverse range of weeds of arable, waste, and disturbed ground plus types which are not referable to specific plant communities. Some taxa, including cereals and contaminants of bread such as blue cornflower (*Centaurea cyanus*), are thought to derive from faecal material and offal disposed of in the stream tributaries of the Thames. Salt marsh plants are also in evidence suggesting tidal/brackish water influences.

Diatoms

S J Dobinson and N G Cameron

Introduction and methodology

Diatoms, which may reveal the level of salinity of the surrounding water and degree of tidal influence, were analysed from five samples taken from the same contexts as were analysed for other environmental evidence: sediments cut by the Tudor river wall and those that built up around its pile foundations.

Diatom preparation and analysis followed standard techniques (Battarbee 1986). Identifications were confirmed using the collection of floras lodged at the Environmental Change Research Centre (ECRC), University College, London. The floras most commonly consulted were Hartley (1996) and Hustedt (1957). The principle source of species ecology was Denys (1992). Data were entered into the AMPHORA database at the ECRC, where they, and the slides and suspensions, are available for examination. A full version of the report summarised here has been deposited with the site archive.

Diatom taxa were classified according to Hustedt's (1957) Halobian scheme in which the halobian groups of diatoms have optimal growth in water with salinity equivalent to the following ranges: polyhalobian > 30 g l^{-1}, mesohalobian > 0.2-30 g l^{-1}, oligohalobian halophilous – optimum in slightly brackish water, oligohalobian indifferent – optimum in freshwater but tolerant of slightly brackish water, oligohalobian halophilous – restricted to freshwater and intolerant of brackish and marine waters.

Although the counting sums were low, ranging from 122 to 183, because of the low diatom concentration the composition of the diatom assemblages was stable and it was thought appropriate to represent the diatom counts as percentages.

Results and discussion

The earliest diatom assemblage, from sediments predating the Tudor wall, is dominated (*c.*65% of the sample) by the non-planktonic oligohalobous indifferent species *Amphora pediculus* and *Achnanthes lanceolata*. Brackish water taxa, of which the estuarine diatom *Cyclotella striata* is the most abundant, account for a further 10%.

The assemblages from higher levels, including some post-dating the river wall, are similar in their overall composition with *c.*60% of taxa being oligohalobous indifferent and 20% of the assemblage being mesohalobous.

The uppermost sample, however, shows an overall decline in the proportion of freshwater species and an increase in the percentage of brackish water species. This probably indicates a higher level of estuarine influence.

Moving up the profile there is a gradual increase in brackish water taxa, such as the estuarine planktonic species *Cyclotella striata*, but also *Rhoicosphenia abbreviata* which has an optimum in slightly brackish water. Nevertheless, despite the decline in freshwater taxa such as *Amphora pediculus* and *Achnanthes lanceolata*, diatoms from the oligohalobian indifferent salinity grouping are still the dominant taxa, accounting for *c.*40% of the assemblage at the top of the profile.

The tidal nature of the estuary results in the transport of marine and brackish taxa into freshwater or brackish habitats and *vice versa*. Fossil diatom assemblages from the Thames estuary are, therefore, taphonomically complex. As polyhalobous taxa did not have an abundance greater than 2% in any of these samples, it is likely that the planktonic marine taxa they contain have been transported from the lower estuary. The dominance of non-planktonic oligohalobous indifferent taxa, however, suggests that much of the assemblage is autochthonous, and that the site of deposition lay in shallow water.

There is no evidence from the fossil diatom assemblage for elevated nutrient (*eg* phosphorous) levels at this site, as has been seen at a number of archaeological waterfront sites in the City (Cameron & Dobinson 1997).

Conclusions

Although freshwater taxa predominate, the number and condition of the planktonic brackish water species *Cyclotella striata* indicates that the river adjacent to Somerset Palace was estuarine. The small percentage of marine diatoms suggests that the tidal head lay further west, although the small decline in oligohalobous indifferent taxa and the increase in mesohalobous taxa towards the top of the profile suggest that the tidal head was moving upstream. The diatoms thus reveal a gradual increase in salinity over time.

DISCUSSION

Duncan Wood, Julian Munby and Chris Hayden

Given its close links to centres of power, it is not surprising that the history of the site of Somerset House reflects some facets of the history of government in England. The aristocratic and royal residence of Somerset Palace, having fallen into ruin, was replaced by Somerset House, which, albeit still incorporating the Royal Bargehouse, was the first purpose-built government office building. Bureaucracy thus replaced aristocracy. The subsequent history of Somerset House reflects the further recession of royal influence. The excavations and building survey in the South Wing and River Terrace have revealed details of how the consequent changes in the roles of this part of the building were reflected in material form: from palace gardens to Naval offices and Royal Bargehouse, through the use of various other government offices, to public art gallery.

Somerset Palace

The features dating from the period in which the site was occupied by Somerset Palace consist

of the river wall and associated bastions, two garden walls, and remains of the paths arranged around the garden. The river wall was constructed at the same time as the original palace and appears to have changed relatively little during its life. The wall itself appears to have been a simple structure, the only elaboration being the roughly central steps leading down to the river, at one stage perhaps associated with a building, and the projecting 'bastions'. In the context of the waterfronts nearby, however, its Portland ashlar facing may have formed an appropriately distinctive foreground for the Renaissance palace that lay behind it.

The two 'bastions' projecting into the river are clearly shown on some plans and drawings in locations which correspond closely to those archaeologically attested (Fig 2), although only one is visible on some earlier plans. The more easterly of the two 'bastions' stands at the end of the wide path running down the western side of the central gardens, and was mirrored by a similar structure on the eastern side. The location of the more westerly of the 'bastions' is less easily explained. It may reflect the existence of some earlier structure. Some kind of feature appears to be obscurely represented at this point on Agas' map of 1551. Engravings from the 18th century appear to show a roof over this bastion, which would thus have formed a small covered space overlooking the river in one corner of the garden.

The stepped ashlar found overlying the bastion provides the only indication of modifications to the river wall recovered during the excavations. Such changes must have been made rather late in the life of the river wall for the bastion is clearly shown in Knyff's engraving of 1720.

The bastions lie on either side of a boundary — marked by the eastern garden wall uncovered during the excavation — which appears to have been maintained throughout the life of the palace, despite the historically attested modifications to the gardens. It divides the main formal gardens in front of the house from a smaller rectangular garden, bordered by trees, in front of the chapel (Fig 2). The western garden wall divides this garden from the road beyond, which leads to a slipway or steps down to the river.

The modifications to the gardens may be reflected by the sequences of crushed tile or chalk and mortar garden surfaces found behind the wall. These would have formed the paths running along the river wall, a feature which appears to have been maintained throughout the life of the gardens.

Tudor artefacts were recovered from the foreshore at the base of the Tudor wall and from backfill deposits relating to the initial construction of the River Terrace and South Wing of Chambers' Somerset House. They add little to the understanding of the area around the Strand during this period. The pottery is all typical of the types of pottery in use in London and is largely domestic in character, although the quantities of material do not permit a specific interpretation. In contrast, the pipe assemblage suggests that high status rubbish from the Palace was being discarded directly into the river during the 17th century.

Environmental analysis has revealed something of the economy of the site and of the character of its environment. Remains of hemp, dyer's rocket, and hops may be related to economic activity in the area around Somerset Palace; strawberry, fig and walnut, as well as cattle, sheep and rabbit bones, suggest a not unpleasant diet, perhaps reflecting that of the occupants of the palace itself. The remains of marigold give some indication of the character of the gardens. Other evidence suggests that the river itself, although it contained sewage and was open to tidal influence, formed a pleasant foreground, of generally fresh, flowing water.

Somerset House

Although the construction of Somerset House heralded a marked change of function, the new building, like the old palace, was used to express prestige, albeit now national rather than personal. The design of the building had been the subject of debate, but Burke's view, that the building should be 'an object of national splendour' prevailed (cited in Colvin *et al* 1976, 367). One of the most impressive aspects of the new building was the massive rusticated arcaded River Terrace which formed its waterfront. Here the Royal Bargehouse, entered through the Great Arch, still recorded the building's connection, albeit now less direct, with the Crown.

The uncovering of the original structure of the Royal Bargehouse and water gate has perhaps been the outstanding result of the excavation. The two original walls of the Bargehouse (or at least the dock) were located to the east of the water gate, and two bays (not three as indicated on the original plans) to the west. Differential wear of the brickwork also indicates

the existence of a slipway, again occupying only two bays to the west of the Great Arch. The absence of any structural evidence between the western Bargehouse wall and the start of the coach house and stables further west may indicate that a loading station existed at the top of the slipway, whilst in any case external access was possible from the portico. Otherwise, the excavation of the eastern and western ends of the River Terrace exposed 18th-century and later structural features from the bargemaster's quarters, the stables, and other working areas either side of the Great Arch in the locations indicated on Chambers' engineering drawings (Fig 5).

Somerset House, however, was not just an opportunity for display. One of the reasons that its construction posed such a challenge to Chambers was that it had to encompass the many and changing requirements of numerous government departments and other bodies. To the original list of departments to be accommodated the Exchequer was added, the Commissioners of Taxes and the Stamp Office both came to require more room (which in the case of the Stamp Office was provided by sacrificing accommodation intended for the King's Bargemaster), and the Foreign Apposer had to be accommodated at the last minute having previously been overlooked (Colvin *et al* 1976, 371). The excavation revealed several indications not only that changes were made during the construction of the building, but also that the building had been planned with change in mind. The difference between the position of the Bargehouse wall on the original plans and in actuality provides an example of the former; the predesigned recesses in each of the piers, allowing changes in usage of the River Terrace throughout its lifespan and during its construction, an example of the latter.

Numerous indications of later changes in use were also revealed. The latest significant structure revealed was the industrial complex to the east of the Bargehouse. Although only partially preserved, the circular chamber and fire-box may have formed parts of a pump. The exact function of this pump is unclear, but it may have pumped water from an artesian spring or well to the Navy Reservoir in the upper floors of the River Terrace. The existence of a system of pipes could not be established but a flue was found running through the north wall of the Terrace from the fire-box. The industrial complex may have been placed adjacent to the the Bargehouse simply because of the need for a regular supply of fuel which could be brought in and unloaded directly from the covered dock, or simply because the archway provided the best means of ventilation. The repairs in the York Stone slab surface suggest that the structure had an extended operational life, but unfortunately no documentary record of the structure can be found.

The construction of Somerset House, and the River Terrace in particular, spanning the steeply sloping and often loose river bank, also posed a considerable structural challenge. Accidents did occur. Five piers in the River Terrace failed in 1789, and the floor of the Royal Academy's Exhibition Room at the front of the building partially failed, just as Sir Joshua Reynolds was presenting a medal in the presence of a large audience (Colvin *et al* 1976, 374, 379). Nevertheless, the excavations and building survey have revealed the care with which this difficult structure was constructed.

The series of well-constructed north–south aligned relieving arches spanning the River Terrace are perhaps the most obvious indication of the measures taken to overcome structural problems. Even here, however, only ten courses of each arch were keyed into the Embankment wall, the remaining courses simply butting against individual piers, giving the impression that the River Terrace had been designed as a framework allowing for future changes in form and use.

The building investigation and recording have similarly revealed changes in planning and use of the building, and added some detail to the extensive written and graphic sources. The most interesting aspect, however, has been the careful investigation of the trussed floor in the River Terrace which has now been removed. The structural carpentry of the building should be seen in the same light as the decorative plasterwork and joinery: as determined high-quality solutions to the problems posed by the building and its intended uses. It is ironic that while the one is rightly recognised as being significant and interesting, the other is not considered worthy of retention (Inskip & Jenkins 1997, 61). Current research in London and elsewhere is only just beginning to reveal the full significance of Georgian carpentry and joinery, which has previously been undervalued.

The creation of a riverside building at Somer-

set House was a brilliant notion on the part of the architect, even if it did not become part of the great London river frontage that might have been anticipated, and was then made redundant by the construction of Bazalgette's Embankment, which half buried it. Something of its original interest has been recovered in the course of these investigations, and the re-entry of the Naval Commissioners' barge to the building in 1999 preserves a tangible reminder of that past.

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