Anne Boleyn Gatehouse Hampton Court Palace

Historic Building Recording and Investigation

oxford archaeology south

August 2009

Client: Historic Royal Palaces

HISTORIC ROYAL PALACES

Issue No:1
NGR: TQ 157 685

Historic Building Recording

Client Name:	Historic Royal Palaces
Document Title:	Anne Boleyn Gatehouse, Hampton Court Palace
Document Type:	Historic Building Recording and Investigation, Client Report
Issue Number:	1

National Grid Reference: TQ 157 685

OA Job Number:	3756
Site code:	HCP58
Invoice code:	HCP58BS
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Date:	August 2009
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Date:	August 2009
Document file location:	\\10.0.0.36\FinishedProjects_read-only_Departmental\Buildings\H\HCP - Base Court (AB Gatehouse)\report\HCP58 report August 2009 FINAL.doc

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Anne Boleyn Gatehouse, Hampton Court Palace

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SUMMARY

Oxford Archaeology was commissioned by Historic Royal Palaces to record and investigate the Anne Boleyn Gatehouse at Hampton Court Palace, Surrey. The investigation and recording work was undertaken during restoration and building works to the gatehouse. Other investigations included the identification of the stonework by Robin Sanderson and the analysis of the painted brick surfaces, Astronomical and slate clocks and the early 18th century cupola and lantern by Catherine Hassall. As well as examination of the gatehouse fabric during the works, opportunity was taken to investigate and record the blocked upper sections of the SE and SW turrets, as well as the accessible parts of the NW turret.

Constructed by Cardinal Wolsey between 1514 and 1522, the Anne Boleyn Gatehouse is set within the east range and is of brick construction with stone detailing and forms part of the original courtyard of the palace. The gateway, as with the rest of the courtyard, provided high status accommodation for courtiers and visitors to the Palace. Following his acquisition of Hampton Court in around 1529, Henry VIII continued with large construction works at the Palace and part of these works included alterations to the fabric of the gatehouse. The late Tudor period and 17th century saw few changes to the fabric but in the early 18th century the gatehouse underwent major structural alterations to a design by Wren. These alterations included the placing of the bells from the NW turret within a lantern situated on top of a cupola in the roof of the gatehouse. Following the use of the gatehouse as part of Apartment 30 during the Grace and Favour period the gatehouse saw many internal alterations. Further changes to the gatehouse fabric occurred during the 19th century including the refacing and remortaring of brickwork and the replacement of the clocks on the west elevation. Ongoing repairs and replacement of brickwork continued during the 20th century.

Several points of interest were discovered during the recording and investigation process. These included the discovery of early brickwork decoration, hidden beneath the lead plaques of the terracotta roundels, all of which were analysed by a paint expert. Internal survey of the blocked areas of the turrets revealed primary phase stone windows and doors, hidden on the external elevation by later refacing works. The brickwork of the lower NW turret was identified as being 18th century in date and of a previously unrecorded type instead of late 19th century T stock bricks as previously supposed. This brickwork was raked back to allow for the application of thickly laid black ash mortar during the re-Tudorisation of the Palace in the late 19th century. A key element revealed during the works was the unusually designed timber ball finial which appears unique and of some historical interest. Graffiti on a lantern cap sarking board give a definite date of 1711 for the completion of the Wren remodelling works.

In all, the works to the gatehouse allowed a high level of recording and investigation of the fabric and therefore a greater understanding of the early construction phase of the palace.

1 INTRODUCTION

1.1 Project Background

1.1.1 Oxford Archaeology was requested by Historic Royal Palaces to undertake building recording and investigation during conservation works on the Anne Boleyn Gatehouse, Hampton Court Palace. Hampton Court Palace is a Scheduled Ancient Monument (Surrey, no: 83). The project was managed by Andrew Harris of Martin Ashley Architects and the Historic Royal Palaces contact was Patricia Les (Surveyor of Fabric Department), with conservation of the terracotta roundels and coat of arms overseen by Zoe Roberts of the palace Conservation Department.

1.1.2 Historic Royal Palaces initiated a programme of restoration and repairs which removed Victorian black ash pointing and replaced damaged bricks and stonework to ensure the structural viability of the gatehouse and to prevent further deterioration/loss of important building fabric. Further works included the replacement of roof leadwork, damaged and unsound timbers and structural repairs to failing turrets. The scale of works provided a unique opportunity to examine large areas of the building fabric and thus provide a constructional history of the gatehouse.

1.1.3 The recording was carried out as per the Specification for Archaeological Watching and Recording Brief issued by Historic Royal Palaces in June 2007. Adjustments to the recording process were inevitable as further investigation necessitated extra recording in certain areas, which was carried out after consultation with Patricia Les and Andrew Harris (Martin Ashley Architects).

1.1.4 Much of the research was undertaken for The Interim Statement of Significance for Base Court (May 2007) by Kent Rawlinson, Curator of Historic Buildings, Hampton Court Palace. The statement of significance is a sizeable document, so for convenience 'Appendix I: Chronology' only is included within the appendices of this report (Appendix VII). This chronology covers key events in the Base Court development along with references to primary sources used. Also included are many of the early views included within the Statement of Significance which show key changes to the gatehouse.

1.1.5 Alison Kelly (Oxford Archaeology Buildings Supervisor) carried out the investigations with the main survey work taking place between August and November 2007 and sporadically after that until the conservation works were completed. Assistance was given on occasion by students from the University of York MA in Buildings Archaeology course.

1.1.6 This history and phasing of the gatehouse is complex and therefore the report has been presented to illustrate the results of the investigations in a clear and concise format. This introductory section includes the aims, methodology and previous work, and Section 2 details the known history of the gatehouse. The remaining

sections cover the eleven phases of the development of Base and Clock Courts as defined within the Statement of Significance (Rawlinson 2007) and assimilates all the information within the following sections: documentary sources, pictorial evidence and archaeological investigations. More specific information concerning the brick typology analysis and other details (graffiti etc) is included within the appendices.

1.2 Aims and objectives

1.2.1 The purpose of the investigation was to:

- Inspect and record in detail the use of vitrified bricks and paintwork within decorative schemes;
- Inspect and record in detail all pointing, mortar and bond types in order to produce a phased summary of the works upon the gatehouse;
- Inspect and record in detail other details such as putlogs, fixings and other features of significance;
- Record the brickwork used on the gatehouse and reformat the existing English Heritage brick typology where necessary;
- Inspect and record in detail blocked turrets and other areas hitherto unrecorded;
- Photographically record all stonework prior to repair or replacement;
- Record leadwork to turrets, cupola and lantern including types of fixings and rolls;
- Record timber framework of the cupola, clock supporting frame and lantern;
- Record graffiti and moulding profiles located on interior and exterior elevations;
- Provide watching brief services during removal of the astronomical clock and its reinstallation following conservation;
- Create an ordered archive of the work for deposition with Historic Royal Palaces.

1.3 Methodology

1.3.1 Overall the work comprised three principal elements: a photographic, drawn and written survey. The ***photographic survey*** consisted of general photographs and specific details (external and internal) and was undertaken using 35 mm black and white print film and colour slide film. Digital photographs were also taken using a Caplio 400G 3.2 megapixel camera.

1.3.2 The ***drawn survey*** used photogrammetric drawings of external elevations provided by Historic Royal Palaces, which were undertaken by the Downland Partnership in 1999. Permatrace was overlain on the drawings, and external elevations (1:40) were prior to and post the commencement of intrusive works. Floor plans provided by Historic Royal Palaces were used to provide reference to archaeological recording, and annotated if required. Further scale drawings were produced by hand and tape at an appropriate scale (generally 1:20) to record and interpret features of particular interest. All drawn records followed IFA Standards and Guidelines and English Heritage specifications (2006). Historic views of the gatehouse were provided by Historic Royal Palaces and these were used in the analysis of the phasing and are referenced throughout this report.

1.3.3 The ***descriptive survey*** complemented the photographic and drawn surveys and added further analytical and descriptive detail. OA building archaeology record sheets were used and referenced to the drawn/photographic surveys and samples to ensure a complete assimilated archive. Brick typology sheets were completed in analysing the brick and mortar types and wood recording sheets were used on all main pieces of timber removed, although in some cases the removed timbers were not separated from the general debris by the contractors and therefore some pieces were missed.

1.4 The Brick Typology

1.4.1 The Brick Typology was completed by Daphne Ford for English Heritage and this document, formed using a mix of visual inspection and archive evidence, establishes a typology for the bricks used at Hampton Court Palace, and includes elevation drawings of the majority of the Palace which have been phased according to this typology.

1.4.2 The recording of brickwork for this investigation involved the completion of Oxford Archaeology brick data sheets. These ensured all categories included within the typology were accounted during investigations, and enabled easy cross referencing to the brick typology as well as other elements of the recording programme (photographic, drawn and written).

1.4.3 The following information was included in the sheets:

- Brick measurements - arris to arris, length, width and depth (in cm)
- Brick type and date – according to the typology
- Description/ Features - description of brick colour, inclusions, diaperwork, etc.
- Bond and pointing
- Mortar
- Further comments

In addition to the recording sheets photographs of identified brickwork with its associated pointing and bedding mortars were also taken to provide a photographic archive for future recording projects.

1.4.4 The brick measurements taken during the survey were recorded on an Excel spreadsheet and an average measurement for each dimension was produced and compared to the Typology. Since measurements in archaeological recording are taken in centimetres, the Typology measurements were converted to centimetres to facilitate comparison. The size analysis was undertaken in conjunction with the description of the brickwork and any differences were further investigated. The results of the analysis are included in this report as Appendix VI.

1.4.5 Previous research by the author on brickwork projects at Hampton Court have produced results generally comparable with the Typology, the only difference occasionally occurring within the measurements as the archaeological recording includes measuring brickwork after the raking out of black ash pointing. This recording project included areas marked by Ford as 'inaccessible' and therefore unidentified on the Typology elevations as well as an area of brickwork which did not match the brick Type given on the typology.

1.4.6 It was found that the analysis of the brick typology with historical references and views was a good resource for determining phasing in the majority of the brick recording. The brick typology is also very useful in ensuring that a complete analysis of the brick and mortar is undertaken, and also has the advantage of enabling one to compare analysis with other locations with the Palace. It is important that any difference raised and identification of previously unidentified brickwork should be added to the typology for future reference.

1.4.7 Overall, the brick typology is a very useful tool and, as a complete study of the Hampton Court Palace, is invaluable to our understanding of the Scheduled Ancient Monument. In using the document, it was noted that information can usefully be added so that subjective descriptions (e.g. uneven surface) are enhanced and of greater use to a wider range of users. It is also useful to attempt to separate the defining characteristics of a given brick type from its general characteristics, as the latter are often shared by too many brick types. In some cases, indicators were contradictory, with mortar analysis, for example, suggesting one type and measurements another. All of this is to be expected in a study of this kind, and shows the need to treat the brick typology as a living document requiring frequent revision and addition.

2 HISTORICAL ANALYSIS

2.1 The Emergence of a Royal Palace

2.1.1 The Knights Hospitallers acquired the manor of Hampton in 1236 and used the land as a grange. The only known buildings at this time were a great barn or hall and a stone camera. The first known occupant other than the knights was John Wode

who obtained a lease for the court, the exact date of which is unknown. Alterations to the building during his time may have included the extension of the residential part of the dwelling by means of a tower. Wode died in 1484 with no heir, and it was not until 1494 that the manor was re-leased.

2.1.2 The next occupant of Hampton Court was Sir Giles Daubeney, who in 1494 acquired and eighty-year lease. The freehold of Hampton Court was unobtainable by Daubeney but he did however obtain a new 99-year lease in 1505. This new lease was much improved allowing him to enlarge the property. Daubeney died in 1508 and when his son came of age in 1514 he immediately gave up the lease to Thomas Wolsey, then the Bishop of Lincoln, but soon to become Archbishop of York and a Cardinal.

2.1.3 As with Daubeney's lease Wolsey's gave permission for alterations to be made to the fabric of the buildings. During his time at the palace Wolsey carried out many alterations and new builds and amongst his earlier works was the construction of the ranges that form Base Court in 1514-1522. Henry VIII, who acquired Hampton Court in 1527/9, continued this building of the palace as he embarked upon a building programme that shaped much of the Tudor palace we see today. During this time existing buildings were removed or adapted and decorated for royal use.

2.1.4 Among the later alterations that are recorded, the major programme of alterations was carried out by William III, who commissioned Sir Christopher Wren to rebuild Hampton Court in 1689. Wren's original plan was to rebuild the whole of the Tudor palace, keeping only the Great Hall. Lack of time and money meant that Wren concentrated his efforts on rebuilding the Royal apartments on the south and east sides of the palace.

2.1.5 After William's death in 1702 the Palace was little used by subsequent monarchs although improvements and alterations to the palace fabric continued. The last reigning monarch to use Hampton Court was George II in 1737. After his succession in 1760 George III decided not to live at Hampton Court, leaving the palace's many rooms unoccupied. It was decided that the lodgings and other rooms in the palace should be divided up into apartments for grace and favour residents who were granted free residency by the monarch.

2.1.6 In 1837 Queen Victoria declared that Hampton Court Palace should be open to all her subjects and the Palace became a tourist destination and visiting antiquarians and artists began to write about and draw the palace on a grander scale than previously done. Parts of the Tudor Palace were gradually restored with the removal of 18th century casement windows amongst some of the building works at this time. Changes to the palace in the 20th and 21st centuries have primarily involved the conservation and restoration of the building fabric as well as the presentation of the palace to visitors.

3 PERIOD 1: MEDIEVAL (TO 1514)

3.1 Documentary Sources

3.1.1 It is thought that a range forming part of the grange of the Knights Hospitaller stood on the site of the Base and Clock courts range. In around 1479 a bell was cast at Thomas Harrys' foundry which is thought to be one of two bells recorded in the inventory of Hampton Court in 1495. Its inscription reads: STELLA + MARIA + MARIS + SUCCVRRE + PIISIMA + NOBIS (Translation: Mary most gracious, Star of the Sea, come to our assistance).

3.2 Archaeological Investigations

3.2.1 A medieval water gate is noted on the historical analysis ground floor plan developed by Daphne Ford for English Heritage (1996). Further evidence for other medieval buildings has recently been discovered during the 2008 archaeological excavations in Base Court, prior to its resurfacing (Report forthcoming).

3.2.2 During the recording of the large bell during the works the initials 'TH' could be seen as part of the inscription on the bell which sits within the upper decorative belt. The presence of these initials confirms that this bell was from Thomas Harrys' foundry. The bell inscription itself is on separate pieces of metal which have then been soldered onto the bell itself. Also included in the inscription is a fleur-de-lys symbol and a flower (rose?). On the curve of the bell above the lip there is a raised double triangular symbol which is probably the individual mark of the person who cast the bell (Plate 10). The interior of the bell shows a circular depression where the strike point has been worn by the clapper.

4 PERIOD 2: 1514 - 1529 (WOLSEY)

4.1 Documentary Sources

4.1.1 Documentary evidence shows that Wolsey began construction on the ranges forming Base Court immediately after his acquisition of the lease of Hampton Court and the work was completed by c.1521. This involved the construction of two gatehouses and four ranges, the ranges having two storeys and the Anne Boleyn Gatehouse three or four principal storeys. According to documentary sources the bricks were manufactured on site at Hampton Court by Richard Recolver of Greenwich (Musty 1990, 412) and the timber cut and fabricated at Barwyn Wood.

4.1.2 The terracotta Wolsey coat of arms was mounted on the east elevation of the Anne Boleyn Gatehouse c. 1521. Two quarter bells by William Culverden, thought to have been cast between 1530/40 (Thurley 2003, 73), were probably cast around this time as Culverden was master founder at the Whitechapel foundry between 1506 and 1522.

4.1.3 Three of the terracotta roundels were produced in 1521 by Giovanni de Maiano, a

Florentine sculptor, and were placed in an unknown part of the Palace until 1771/2 when they were moved to their current locations on the gatehouse turrets.

4.2 Archaeological Investigations

Brickwork

4.2.1 The primary material used in the construction of the gatehouse are Wolsey phase Type A bricks. The bedding mortar is cream coloured with lime inclusions of mixed sizes. These bricks are mostly laid in an English bond but there are some variations to form diaperwork. Putlogs on the central section of the east and west elevation were identified during raking out of the black ash mortar, however it was unclear as to which phase they belonged, as they contained traces of a different mortar mix which is connected with the resetting of the upper east elevation during the installation of the Astronomical Clock in around 1540 (as discussed in §5.2.4 below). It is possible that the primary phase putlogs were reused during the Henrician works. It is also possible that much of the existing upper brickwork was reset during the installation of the staircase entrance to the Great Hall introduced by Henry VIII in c. 1536. The cream coloured lime mortars used for these early 16th century phases are extremely similar making it difficult to interpret the building construction.

4.2.2 The diaperwork is made using vitrified bricks and is generally located on the turret faces. Most of the diaperwork consists of a wide-meshed all over design which is a typical design for later diaperwork (Smith 1992, 24). The lozenge shape is repeated in a column design on the lower sections of the east elevation turrets. Despite extensive refacing works in later phases the diaperwork designs on the gatehouse can be seen to be very fragmentary, however this appears to be the same with the rest of Base Court which has areas where the diaperwork is patchy (White 2005, 81). White (2005) argues that the diaperwork was laid using available vitrified bricks but did not continue when the supply of bricks ran out. Evidence suggests the diaperwork was painted onto the external elevations after construction. The central face of the lower part of the NE turret also features a cross design, a style that had been popular in ecclesiastical buildings since the late fifteenth century but is uncommon at Hampton Court (Goodall 2002, 256).

4.2.3 The uppermost sections of the turrets and the north and south elevation are identified as inaccessible on the brick typology elevations but were possibly thought to be possibly part of the Wren works of 1710/11. However, analysis of the brick sizes and appearance shows that this brickwork is probably Type A bricks and related to the primary build of the gatehouse. The mortar is cream coloured with lime inclusions and the same as seen on the central sections of the gatehouse elevations. Both north and south elevations have fragmentary diaperwork, formed using vitrified bricks, which is a further indicator of an early 16th century date. As discussed previously, it is possible that this brickwork was substantially reset during the Henry VIII works. There is no indication of the pitched roof depicted in

Wyngaerde's views of c.1558 (Plate 1), which was probably part of the original construction.

Moulded Brick Window

4.2.4 There is a small window on the SW turret which does not have stone dressing but instead uses moulded brick (Plate 12). The brickwork has been subject to patch repairs and the hood mould is in a fragmentary state. The bricks are not regular enough to provide measurements but the appearance and the cream coloured bedding mortar suggest the window was part of the primary construction of the gatehouse. The window has been repointed in the 19th century using black ash mortar which has penny rolling applied.

4.2.5 Similar style moulded brick windows can be seen at Leez Priory (c.1536) and Layer Marney (c.1520), both situated in Essex. The Layer Marney windows were originally rendered so it is entirely possible that the brickwork here was covered with render which would have resembled stone (A. Harris, pers. comm.). Moulded brickwork is not commonly seen within the remaining Tudor part of the palace and its use within Base Court, which was used as high status accommodation, is unusual.

Removal of SE roundel plaque

4.2.6 Removal of the name plaque beneath the terracotta roundel on the SE turret revealed double struck pointing with a red wash (also called ruddling) applied over the brickwork and pointing (plate 48). Double struck pointing without paint traces is on the brick typology for the east range of base court (Ford 1991) and is a pointing model for all brickwork from this phase of the construction of Base Court. It is possible that traces of the paintwork had weathered away elsewhere but were preserved by the addition of the plaque on the turret. White (2005, 81) argues for the complete painting of the elevations as a sign of status, and the surviving decoration of the east wall of the Chapel constructed by Wolsey in 1522 would suggest the Base court was similarly decorated. Recent excavations in Base Court revealed what appeared to be ruddling on some below ground brickwork on the West range (OA forthcoming).

4.2.7 According to the statement of significance, the plaque was placed over Wolsey Type A brickwork in c.1771 and it is possible the brickwork had been repainted or repaired prior to this. However, analysis of the red paint by Hassall (Appendix II) confirmed the red colour was red iron oxide without brick dust inclusions and was very similar to the red colour examined on the Chapel east wall, which dates to the Wolsey construction phase of Hampton Court (Hassall 2008b, 6). This suggests the red paint found is Wolsey in date and part of the original exterior decoration.

Interior stonework within gatehouse

4.2.8 Investigation within the room beneath the clock room revealed stonework set within

the brick elevations (Fig 9). On the northernmost wall this appears to relate to a large infilled area of brickwork on the north external elevation, most likely for a window. On inspection of the upper portion of stonework visible on the exterior the chamfered edge can clearly be seen. This stonework has been identified by Robin Sanderson as Wheatley Limestone which was commonly used during the early construction phases of the palace (Sanderson 2008, 5). Within the room beneath the clock room there are also sections of quoins in the NW corner indicating a former doorway to the NW turret. A blocked doorway was noted during investigations within the NW turret (see Appendix V). The stonework does not appear to relate to the current arrangement of the gatehouse and it is possible that this is part of the primary phase stonework which was infilled during remodelling by Henry VIII as discussed in §5.2.3 below.

Stone Analysis

4.2.9 From the lithological survey by Robin Sanderson (Appendix III) it is clear that the stone types used in the primary construction phase included Wheatley Limestone and Reigate Sandstone. Despite extensive replacement of stonework there are some areas where potentially primary stonework remains.

4.2.10 Caen Stone is often used in areas of high prestige and where detailed carving is required as the grain is smooth from the absence of shell fragments and fossils. It had been thought that Caen Stone was first used during the Henrician construction phases (R. Sanderson, pers. comm.), however, the use of Caen Stone in the top section of the gateway arches probably dates to the primary phase of construction. Caen Stone can also be seen on much of the window stonework in conjunction with Wheatley Limestone, either of which could have been used for later repairs.

4.2.11 The masons lodge thought to have been used during the construction of Base Court was recently revealed during an excavation within the courtyard (OA forthcoming). The floor appeared to consist of layers of stone dust and chippings which were sent to R Sanderson for analysis. This analysis indicated there was no presence of Caen Stone within the sample which would confirm that Caen Stone was mainly used during the Henrician stages of work.

4.2.12 Analysis of the motto beneath the Wolsey terracotta plaque on the east elevation identified the material as decalcified Reigate Stone which is the only remaining piece of Reigate Stone on the exterior of the gatehouse. Reigate was used by both Wolsey and Henry VIII, but the motto is Wolsey in date as Henry's motto which overlaid this was of lead (See §5.2.1 below). Much of the exposed stonework within the tower interior, particularly that relating to the Wolsey and Henrician phases, can be identified as Reigate Stone.

Oriel Window Frame

4.2.13 Removal of the decorative panels on the part of the oriel window revealed an 18th century brick retaining arch set within the primary phase elevation brickwork. It is

thought that the upper part of the oriel window was reset during 18th century works.

4.2.14 As well as replacement of much of the window stonework, the timber frame holding the stone panels in place is a 19th century replacement but it is assumed that a similar design was part of the primary structure. One of the decorative panels in the upper part of the west elevation oriel window has been identified as Wheatley Stone and therefore probably part of this primary phase.

5 PERIOD 3: 1529 - 1547 (HENRY VIII)

5.1 Documentary Sources

5.1.1 As seen in other parts of the palace, Henry VIII often adapted the Wolsey coat of arms to show his coat of arms instead. In June 1531 Henry VIII inserted his coat of arms constructed in painted iron and stone (possibly Reigate Greenstone) over the Wolsey terracotta coat of arms set within the brickwork of the west elevation. These arms remained in situ until their removal for restoration in 1845 and were described by Edward Jesse in 1845:

'... his arms were placed over those of the Cardinal…portions of which were cut away for the purpose of inserting the arms of the King, which were carved out of fire-stone, or that peculiar grey stone then much used. The royal supporters were placed very ingeniously between those of the Cardinal; and, to conceal everything belonging to that prelate, the hat was covered by a crown worked in wrought iron'. (Letter to The Gentleman's Magazine, 17th November 1845)

The only pictorial depiction of the Henry VIII arms in situ is John Spyer's view of the Western range of clock court (c.1780) and this image shows the arms flanked by columns similar to those within the Wolsey arms suggesting the central feature was only covered with ironwork. The motto attached over the stone motto of Wolsey below the arms was of lead.

5.1.2 Later in 1531, a painted stone coat of arms was installed on the lower section of the oriel window on the west elevation (SOS), this was later replaced by a copy in Portland Stone. Following the construction of the Great hall in 1532-36, Henry VIII inserted a staircase in c. 1536 leading up to the principal floor of the Great Hall. This staircase provided a grand entrance to the Great Hall and a new stone vault was installed with the initials of Henry and Anne included in the carved decoration (Thurley 2003, 51).

5.1.3 In 1539 the Astronomical Clock was designed, most likely by the Kings Astronomer Royal, Nicolaus Kratzer. The Clock was constructed by Nicholas Oursian in 1540 and the initials NO and the date 1540 can still be seen inscribed on the Clock frame (Heath Archive, XIX). To accommodate the Astronomical Clock the upper portion of the gatehouse was remodelled. It is likely the bells were added to the NW turret of the gatehouse at this time.

5.2 Archaeological Investigations

The Great Stairs

5.2.1 The great staircase entrance to the Great Hall had its brickwork refaced in the 19th century and has been subject to much restoration. Visible changes to the gatehouse made at this time include the blocking up of two stone doorways leading from the turrets to the accommodation within the central part of the gatehouse. The doorways are within the NW and NE turrets on the principal level (Plates 18 &19). A blocked door in the room beneath the clock room was probably blocked during the installation of the Astronomical Clock below. The NE turret blocking in has been rendered and covered in limewash and can be seen from within the turret. An iron bar has been added at a later date, presumably to strengthen the infill during refacing works in the 19th century. The stairs do not have a landing at this point suggesting they are a later replacement, possibly only in this section.

Insertion of the Astronomical Clock

5.2.2 The insertion of the Astronomical Clock necessitated the alteration of the upper part of the gatehouse. The west elevation contained a small dial - this was removed sometime around 1835 and the subsequent refacing of the elevation in the 20th century left no trace visible at this level during the recent works. The larger dials were inserted into the east elevation and set within a stone surround. The brickwork surrounding the clock appears to be of Wolsey stock bricks but has been substantially reset. The mortar for this phase is a paler cream colour than for the primary phase and appears more friable in texture. There are four putlogs visible within the elevation beside the Astronomical Clock which all appear to date to the Wolsey construction phase, but have been subsequently reused during these works (Plate 13). The upper SE putlog is around 150 x 150mm square and this size is even throughout the length of the cavity which is approximately 730mm deep. It is apparent that the primary phase brick wall was formed around the timber but there is a mix of Wolsey and Henrician phase mortar traces within the cavity. There is a small fragment of timber located at the rear of the opening. A similar putlog on the north-east side of the central elevation has been infilled with early 16th century bricks, two of which are laid on edge. There is a 19th century brick inserted within this infill with black ash mortar.

5.2.3 Samples of the paintwork on the front of the Astronomical Clock dials were taken and analysed by Catherine Hassall. There were two samples containing azurite which relate to an early paint scheme, however azurite is used up to c.1700 and so the samples taken could be from a later 16th century repainting (Hassall 2008a, 1). No traces of early paintwork were found on the reverse of the dials (Hassall 2008a, 2).

5.2.4 On removal of the great dial three concentric circles of stone voussoirs could be seen surrounding the opening into the clock room. The stone has been identified as Caen Stone by Robin Sanderson (Sanderson 2008) and is therefore probably part of

the Henrician phase of works. The outer ring has been partially cut by replacement Clipsham limestone inserted during the 1960s restoration works (Plate 15). The two inner rings which would have been hidden beneath the great dial are roughly cut with some chisel marks visible. On this face there are some incised markings which are roughly similar to some painted decorations on the great dial of the clock, in particular the symbol for Scorpio (Plate 16). It is not know why these incised marks are on the stone voussoirs as they would have been hidden by the dial; however it is possible they could be for setting the clock.

5.2.5 There is painted decoration on the remaining outer ring stonework, which is usually covered by the chapter ring, but would have been visible initially. These are two sets of twelve Roman numerals, representing the 24 hour clock, separated by fleur-de-lys decoration. The numerals and fleur-de-lys are gilded and the background is black. Analysis of the paintwork by Catherine Hassall revealed many layers of paint suggesting the stonework was exposed for a considerable period. The current chapter rings were installed during the 1947 works (Hellyer and Hellyer 1973, 14). The samples taken showed evidence of seven different paint schemes and the sanding down of the surface in the 19th century leading to a possible loss of layers. The original scheme was a layer of stone coloured paint applied directly to the stonework, followed by the gilding of the numerals. A layer of black was also found but this may apply to a later scheme. There was no evidence for the fleur-de-lys decoration at this point but this is not conclusive (Hassall 2008a, 8).

5.2.6 It is possible that the blocking of the stone window on the south elevation also occurred during these works. The bricks used as infill measure 54-60 x 212-220mm and are, on the whole, very similar to those used within the remainder of the elevation. They are laid in a header bond, which is usual for this period but may be due to the fact this is a patch of infilling which generally would be unseen. The infilling has recently been remortared with a sandy coloured hard concrete mortar making further identification difficult.

5.2.7 Although the majority of the internal clock mechanism is later replacement, the inscribed spider can still be seen (Plate 17).

Other Stonework

5.2.8 As discussed previously, we cannot determine the difference between Wolsey phase and Henrician phase stonework, however it is likely there was some stone replacement during this phase.

6 PERIOD 4: 1547 - 1603 (LATE TUDOR)

6.1 Documentary Sources

6.1.1 Documentary evidence for this phase is limited to repairs and repainting of the astronomical clock during the late 16th century (Heath Archive, XIX; E 351/3226 and E 351/3219).

6.2 **Pictorial Evidence**

6.2.1 *Wyngaerde (c. 1558)* - Three sketches of Hampton Court Palace depict the gatehouse in varying details. It can be seen on all of them that the gatehouse has a central pitched roof with gable wall facing onto Base Court. The turrets have 'onion' types topped with finials, a style also seen on the Great Gatehouse and the Great Hall. In each of the three sketches, the NW turret is clearly different with arched openings in the walling beneath the roof, indicative of its use as the bell turret. One image shows the bell turret as distinctly taller than the other turrets, however this could be an error with perspective. The oriel window is not clearly depicted (Plate 1).

6.3 **Archaeological Investigations**

Graffiti

6.3.1 Amongst other inscriptions, there is the date '1570' roughly inscribed on a stone in the room beneath the clock room. This is the earliest dated graffiti found during this recording project. (See also Appendix IV)

7 PERIOD 5: 1603 - 1689 (STUART)

7.1 **Documentary Sources**

7.1.1 Again documentary evidence for this phase is mainly centred on the repairs and maintenance of the Astronomical Clock. Both dials were repainted by John de Crete in 1619/20 (E 351/3253; Heath XIX) and the mechanism was repaired by Richard Nurse in 1647/48 (Heath XIX; NA AO 1/2431/79). The dials were repainted again by Robert Streeter in 1664 (WORK 5/6; E351/3278; Heath XIX). The frame of the clock was mended by carpenters in July 1679 (WORK 5/32: Heath XIX) and in 1680/81 the dial of the clock was repaired by Henry Wynne (E 351/3294; Heath XIX).

7.1.2 At some point prior to 1674 the third floor lodging above the great stairs was either created or remodelled for Mr East (Ford 1991); casement windows were inserted in the east and west elevations of the base/clock court range adjacent to the gatehouse.

7.2 **Archaeological Investigations**

7.2.1 There was no conclusive evidence of changes to the gatehouse at this time.

8 PERIOD 6: 1689 - 1714 (WILLIAM &MARY; ANNE)

8.1 **Documentary Sources**

8.1.1 Various minor maintenance and repairs to the Astronomical Clock and the timber frame were undertaken between 1699-1700 (Heath XIX; WORK 5/51; AO 1/2446/138). Around 1701 the plinths on the west and east elevations were refaced

with Type I bricks (Ford 1991). Between 1702 and 1707 the clock was repaired twice – by Thomas Herbert and then Mansel Bennett.

8.1.2 In 1707 a proposal for the remodelling of the gatehouse was put forward by Christopher Wren (WORK 6/14: Heath IXX).

28 August 1707

A Turrett at the second gate whereon the Bells and clock stood at Hampton Court being too slightly built at first was by the shaking of the bells and age so ruinous that wee judged it in danger of falling and shoared it up. Wee think the Clock and Bells will be more decently and securely placed in the middle of the Tower. Wee have computed that the charge of taking down the old Turrett and rebuilding it with new bricks, putting new Capps to the Turretts, making a new Cupilo for the Bells, translating the Clock, new leading the Roofe of the said Tower will amount to £700.

Chr Wren
Benj Jackson
Jno Churchill

8.1.3 To date no plans or other documentary sources have been located for this phase of work which makes this remodelling one of the least documented of Wrens works, however the lantern bears a striking similarity to a sketched 'study of a lantern' contained within the Wren Society folios of Wren drawings (Plate 3).

8.1.4 In January 1710 clockmaker Langley Bradley submitted a proposal for the building of a 'Turett Quarter Clock'. This replaced the mechanism but retained the inscribed Tudor part of the frame. This clock was to be installed 'on or before 25 July 1711' (WORK 6/5; Heath XIX)

8.2 Pictorial Evidence

8.2.1 There are two contrasting views of the gatehouse from this phase. It is possible that the differences in the turret types are due to artistic licence or the artists' drawing from memory but the pitched roof of the gatehouse appears to have been replaced with a flat roof, probably during the Henrician works.

8.2.2 *Kip, after Knyff (1702)* - This painting shows the central section and the turrets to have flat roofs. The south elevation is shown with a possible window and the top of the central section is crenellated.

8.2.3 *Knyff (c. 1703)* - This painting clearly depicts the Clock Court face of the gatehouse. The turrets still have 'onion' types and the colour suggest these are covered in lead. The astronomical clock can be seen but the window directly beneath this is not depicted. The pitched roof previously depicted cannot be seen (Plate 2).

8.3 Archaeological Investigations

Repairs to gatehouse plinths

8.3.1 Sections of the plinth on the east elevation have been repaired with Type I bricks which are late 17th to early 18th century in date. These bricks are plum/brown coloured and measure 59-65 x 220-224 x 102-107mm. The mortar is sandy coloured and has penny roll pointing.

The Cupola Frame

8.3.2 The cupola inserted by Wren consists of eight faces divided by ribs/shoulders. The frame is of softwood timber construction and covered with rolled lead. The frame consists of eight large dragon ties resting on a square frame supported by braces. Following replacement of leadwork in 1827 the majority of the softwood sarking boards of the cupola were also replaced at this time, however many of the boards forming the ribs appear older and probably date back to the primary construction phase.

8.3.3 The inside frame is constructed of oak which had been fast grown (and therefore unsuitable for Dendrochronology sampling) and has been subject to much reinforcement over the years. The earliest identifiable phase is probably part of the Wren construction 1707-1711. There may be earlier timbers that have been reused, either within the Wren frame or part of later alterations, however there is no clear indication this is the case. Larger timbers often have a waney edge and large knots are left protruding showing they have been roughly hewn in parts.

8.3.4 The lantern posts protrude through the lantern floor and down within the cupola frame and are tenoned into a square frame which has each corner numbered I to IIII with incised chisel marks. One side of this frame is of later replacement timber. This square frame sits on another frame that is embedded into the brickwork of the north and south elevations; these timbers appear primary with no empty mortices suggesting reuse. This frame has four posts which, with raking struts, rise up 122cm to support a square frame. Outer parts of this connect into the east and west elevations providing support for principal rafters. The exact connection is unclear due to the surrounding 19th/20th century timbers and supporting ironwork, however there are also forelock bolt connections, a type used by Wren elsewhere in the Palace. The heads of these bolts are visible beneath the ribs on the exterior. Two forelock bolts are also located at the top of the principal rafters and these connect the external decorative baroque scrolls to the frame.

The Lantern and Bell Cradle

8.3.5 The lantern frame is of oak construction and consists of eight angled posts which sit at each corner of the octagonal base (figure 14). The posts are connected together at the top by timber spandrels set between each post and above this rests the timber plate for the cap frame and the cornicing supports. The posts and spandrels have chiselled assembly markings made with a 1½ ” chisel - these do not run sequentially and the number IIII is a re-occurring mark suggesting this is marking the part as

opposed to the joint (Plate 42).

8.3.6 The base of the lantern continues the octagonal shape seen above as the posts continue downwards into the cupola frame. Crossed braces provide extra support at this point and fixed to the posts externally are softwood sarking boards. A panelled detail is added by fixing extra boards in a rectangular shape onto the sarking boards. Moulded skirting is used beneath this. The baroque scrolls are made up of two oak pieces connected by a free tenon (Figure 15). The scroll is fixed to the principal rafter inside the cupola frame with a 65cm forelock bolt through the neck of the scroll (Plate 45). Another bolt is located on the lower section of the scroll and this is fixed to the cupola rail/bearers beneath. Both bolts sit within scallops providing a flat surface for the leadwork.

8.3.7 The bell cradle consists of two sets of wooden posts resting on a square frame within the cupola room. (Figure 13, Plate 43) The posts are joined together with cross braces. The upper rail has a profiled top section, into which the headstock is inserted, and this is fixed with large nails. There are two unleaded ornamental polygonal decorations at each end that have been painted grey. The lower rail does not rest on the floor of the lantern but approximately two inches above. The leadwork is not fixed underneath this rail which has lead to decay. The majority of the bell cradle timberwork has chiselled assembly marks on both exterior faces of the posts, rails and braces. The northern frame has sections cut from the timber, the lower two of which are blocked, the upper two remain open. This is probably connected to the hanging of the bells (and potentially the rehanging undertaken in the 19th Century).

8.3.8 The lantern cap is covered with softwood sarking boards which were nailed to the curved rafters. The central octagonal post rests on a short timber beam that sits on the supporting timbers connected to the top of the lantern posts (Plate 41). This beam has a large rebate and is probably reused. The upper part of the post has the ribs of the lantern cap roof tenoned in and above this the post is moulded to provide the base for the ball finial (Plate 40). Above the moulding the post continues upwards within the ball finial.

8.3.9 Many of the cap sarking boards have incised markings, mostly doodles or cut marks made during the construction process. However, one notable inscription reads '1711 E C'. This inscription suggests that the construction of the lantern cap was near completion in 1711. (See also Appendix IV)

The Ball Finial

8.3.10 Removal of lead on the ball finial revealed an unusual structural design (Plates 36-39). The ball finial is made of many curved pieces of oak nailed to two oak ribs that encircle the circumference of the ball at an angle. The ribs are jointed together and fixed with small wooden pegs and rebated for the infill pieces to overlap. The infill pieces are nailed to the ribs with small 40mm square nails. There are two pieces that have lap dovetail joints at each end and these form part of the central

support between the ribs. There is a central pin fixed with metal straps (10.5cm long) to the top of the lantern cap octagonal post (7 cm of post is clear underneath the metal straps) and this rises 30.5 cm to the top of the ball. The octagonal posts ceases to be octagonal and is shaped forming a base for the moulding underneath the finial and rising into the finial it becomes a square post with each corner slightly chamfered.

8.3.11 The square headed pin goes through three loose blocks of timber, presumably to provide extra support, and sits within a rebate at the top of the ball. The ball is rebated to allow for lead welting. This appears to be part of the original design and therefore it appears the ball was always intended to be leaded. The lead was applied in four sections and the joins rubbed together with plumbers metal (a mix of lead and tin), the interior of the finial having traces of plumbers metal which presumably leaked through the central pin hole. The ball is further anchored to the post by two 38cm long pins (with 4cm dia. circular head) which go horizontally through the base of the ball and post.

8.3.12 There are few records made of finials as many have been replaced, however the design is usually a solid piece of wood which is then covered with lead. The design of the Hampton Court finial appears unique. A similar hollow ball with central post was designed by Wren for use on St Paul's Cathedral and the lantern there was being constructed in 1707, at the same time as Wren submitted his quotation for works at Hampton Court. The St Paul's finials are constructed with a copper outer shell on an iron framework and the conservation architect at St Pauls' has suggested that Wren was concerned with the weight of the finials and any extra pressure they may put on the roof structure (Martin Stancliffe Pers. comm.). Therefore, it can be supposed that the same thoughts of minimising the extra weight on the gatehouse were in Wren's mind when he designed the lantern and finial at Hampton Court. It was also suggested that the Hampton Court finial was actually the wooden mould used for the St Paul's finial (Martin Stancliffe Pers. comm.), however this is unlikely as there was a great amount of carpentry work required to form the Hampton Court finial which would not be necessary for a mould. It is interesting none the less that the interior fixing of the St Paul's finial uses a similar iron post to that seen at Hampton Court.

8.3.13 The finial fragments were examined by Dr Dan Miles of Oxford Dendrochronology Laboratory, however no samples were taken in order to preserve the remaining fragments. Dr Miles suggested (Pers. Comm.) the finial was fairly roughly constructed and therefore probably the work of a carpenter rather than an expert joiner who would have constructed the dovetail joints with a greater execution.

Stone Analysis

8.3.14 Wren used Portland Stone extensively throughout the 18th century works on the palace and some Portland Stone used on the parapet wall of the south elevation and as the sill of the south elevation window probably dates to this phase of rebuilding.

It is possible that the stone coat of arms on the west elevation is also part of this phase but it is probably part of the 19th century re-Tudorization works. Portland Stone was also used for the replacement of the lower jamb of the east elevation archway. Another stone commonly used during this period is York Stone. This is generally used for utility pieces such as the drain surrounds seen within the pathways of Base Court. Within the gatehouse, York Stone has been used for the sills of the windows on the north elevation (Sanderson 2008).

Dendrochronology

8.3.15 Dendrochronology samples were taken from two of the oak scrolls by Dan Miles from Oxford Dendrochronology Laboratory during the works. The absence of oak within the frame structure and the lack of suitable samples meant that no dates were produced from the small amount of samples taken. The interior of the cupola was also inspected by Dr Miles to ascertain suitability for sampling and again, no timbers that were suitable were found.

Paint Analysis

8.3.16 Analysis of paintwork and gilding on the lantern and cupola by Catherine Hassall (Appendix II) enabled a fuller understanding of the decoration of the lantern and cupola at time of their construction. The lead on the cupola showed no trace of paintwork suggesting this had never been painted. The ball finial had been gilded as part of the original early 18th century scheme over a base layer of stone colour paint followed by a layer of yellow oil size. The lantern itself was primed with red iron oxide and a dark grey undercoat of lead white and carbon black. The lead was then fixed to the timber frame and these two coatings were repeated. The exterior, posts and skirtings/capitals were painted with a stone coloured paint and the remaining interior surfaces (bell frame and interior walls) were painted black.

NW Turret repair and terracotta plaque removal

8.3.17 The lower section of the NW turret clearly has different brickwork to the rest of the gatehouse. The assumption has been that this brickwork consists of Type T – a 19th century stock brick and the red brick colour is very much like type T bricks. On closer inspection of the bricks it can be seen that the bricks have had the visible arrises raked back to allow for a larger application of black ash mortar (Plates 51 & 52). Underneath this pointing it can be seen that the brickwork is in fact high quality gauged brickwork with a creamy lime mortar. Removal of the roundel plaque shows the high quality of this work and the scored detail to the pointing. The measurements for the brickwork prior to raking out were: 50-55 x 191-200 x 85-88mm with an arris to arris measurement of 249-250mm. Following raking out of the black ash mortar the measurements were: 60-63 x 203-206 x 94-96mm with an arris to arris measurement of 257-263mm.

8.3.18 Since the roundels were apparently in their current location by c. 1771 it is assumed that the lead hood moulds and plaques were also fixed to the turrets at this point,

which makes the use of 19th century brick unlikely. The quantity of lime used in the mortar also points to a pre 19th century date. However, further research of other gauged brickwork within the palace and size analysis of the bricks both before and after raking out has failed to indicate a specific brick type. It is therefore supposed that the lower turret was refaced during this phase using a previously unknown brick type and further cosmetic changes to the brickwork undertaken in the 19th century, probably in an attempt to match the adjoining Tudor brickwork (see §11.3.2 below).

9 PERIOD 7: 1714 - C.1760 (GEORGIAN ROYAL PALACE)

9.1 Documentary Sources

9.1.1 As well as general repairs to the clock between 1719 and 1732 (Thurley 2003, 419; WORK 4/2; Heath XIX; AO 1/2454/166) a single storey crenelated porch was added connecting the SE turret of the gatehouse and the ground floor of the adjacent range sometime between 1718 and 1770 (Ford 1991).

9.2 Archaeological Investigations

9.2.1 It is possible that the refacing of the NW turret as discussed above (see §8.3.16) was undertaken during this phase; however, the documentary evidence suggests it was more likely to have been done during the major construction works of 1710/1711.

10 PERIOD 8: C.1760 - C.1838 (GRACE & FAVOUR PALACE)

10.1 Documentary Sources

10.1.1 It is reported that the four terracotta roundels that adorn the Anne Boleyn Gatehouse turrets were placed in their present location in c. 1771. The clock structure was reinforced in 1785 (WORK 5/74) and in 1794 the dials of the clock and the surrounding stone frame were repainted by Elizabeth Betts (WORK 5/83; Heath XIX). The stone frame was, however, cleaned and repaired less than a year later by John Vilder (WORK 5/84; Heath XIX). The ball finial of the bell lantern was gilded in late 1795 (WORK 5/84; Heath XIX). The cupola was painted in 1809 (WORK 5/98; Heath XIX). In 1835 extensive repairs to the astronomical clock included the replacement of the mechanism with another made for St James Palace (manufactured in 1799 by BL Vulliamy (Law III, 344-5)). Following the loss of the Tudor dial, the slate clock face and William IV's monogram from St James's Palace was inserted into the Base Court elevation of the gatehouse.

10.1.2 After the decision by George III to use Buckingham House as his permanent residence, the accommodation at Hampton Court was gradually allocated to select tenants as grace and favour accommodation with warrant for residency granted by the King and the Lord Chamberlain (Thurley 2003, 327). The gatehouse became part of Apartment 30 which occupied much of the adjoining ranges. The earliest

recorded tenant was Mrs Anne Brundell although there is no date for her tenancy. Lady Bowyer was in residence on 21st March 1768 and Mrs Carey on 18th July 1786. Mrs Mary Ware Bampfield occupied until 1807 when she moved to Apartment 21. Mrs Catherine Chester was in residence on 16 December 1806, followed by Mrs Mann and Lady Hervey. Mrs Margaret Vesey moved into the apartment from Apartment 47 in 1818 and remained there until 1840 when she moved to Apartment 35 (Parker 2005, 81).

10.2 Pictorial Evidence

10.2.1 *Sparrow 'Hampton Court, Middlesex' (1773)* – This view of Base Court shows that the turrets are now topped with crenelations hiding a flat leaded roof. The greatest change is the introduction of the cupola and lantern which contains the bell previously sited in the NW turret. There are two round objects inserted into the upper floor of the gatehouse: the lower is larger and clearly a clock; the upper is smaller and is possibly another clock. The turrets both have terracotta roundels attached and these appear to have the name plaques beneath and a protective hood above. The detailing in the stonework of the oriel window appears consistent with the current design.

10.2.2 *John Spyers 'Western range of Clock Court' (c. 1780)* - This view clearly shows the astronomical clock and the window to the room beneath. There is a porch at the base of the SE turret and connected to the adjoining range. This porch is a single storey extension with crenelated parapet and round window. The coat of arms depicted is for Henry VIII which was inserted in iron over the Wolsey terracotta arms we see today. This is the earliest image depicting the roundels in situ for this elevation of the gatehouse (Plate 4).

10.2.3 *John Spyers 'West Front of the First Principal Courtyard' (1786)* - This view of the west front of the first principal court shows the two clocks in clearer detail This drawing surface of the courtyard depicted green in colour but this is more likely an artistic interpretation.

10.2.4 *John Spyers 'South Front of the Second Principal Court' (1786)* - The detail of the gatehouse is in shadow however we can see the side elevation of the porch added in the early 18th century and this has an arched doorway detail similar to that of the window on the east face. Part of the south elevation of the gatehouse is also visible although no details other than a small chimney stack can be seen.

10.2.5 *John Spyers 'North Front of the Second Principal Court' (1786)* - This picture also shows the gatehouse in shadow and the only visible detail is the access niche and doorway for access to the north east turret.

10.2.6 *Samuel Lysons (c. 1800)* - This unfinished sketch is quite detailed but does not show any detail of the gatehouse not already depicted by John Spyers.

10.2.7 *Lysons 'Entrance court of Hampton Court Palace' (1800)* - This black and white

sketch of Base Court shows the two clocks on the west elevation and the truncated stonework surrounding the larger clock which is similar to that seen today.

10.2.8 *Anon. Base Court (through Anne Boleyn Gatehouse)(1800)* - This sketch depicts the gateway arch and vault in detail prior to its restoration by Lessels in 1880. The interior facing of the elevation within the archway shows the building material as stone, however this is possibly an interpretation or mistake by the artist.

10.2.9 *W Westall 'Quadrangle, Hampton Court' (1819)* - This colour drawing shows the paint colours used on the lantern. The lantern is painted stone or cream from above the cupola; the same colour has also been used on the finial apron. The cap has not been painted and the ball finial is gilded. Some diaperwork is picked out in the top section of the NW turret but no other diaperwork is shown on the gatehouse. All features (roundels, windows etc.) are clearly shown except for the small brick window on the south west turret which is excluded, probably due to the angle of the picture. The adjoining ranges have chimneys which were later replaced with Tudor style decorative ones.

10.2.10 *AW Pugin 'PL. VI. Hampton Court Palace. Oriel window above the second gateway' (c. 1821)* - This is a measured drawing of the oriel window which includes an elevation, plan and section and also shows moulding profiles. The stonework is clearly depicted but the surrounding brickwork has not been drawn other than for demonstrative purposes. The drawing extends downwards to include the arch of the archway beneath. Pugin meticulously recorded the architectural details of many historic buildings and therefore this drawing can be concluded to be fairly accurate, however condition of bricks and stonework would not have been recorded.

10.2.11 *AW Pugin 'PL. VII. Hampton Court Palace. Arch. Groining...to 2nd Gateway'(c. 1821)* - This is another scale drawing from Specimens of Gothic Architecture published in 1821-1823. This is a scale drawing of the groining showing a small plan of the ceiling with a detailed section and plan of a quadrant of the ceiling.

10.2.12 *Emily Rose Prinsep '1st Court Hampton Court' (1826)* - This colour drawing is interesting because it clearly depicts the difference in brickwork on the upper and lower parts of the north west turret and shows this at an earlier date than previously thought (Plate 5).

10.2.13 *John C Buckler 'West view of the first quadrangle of Hampton Court' (1826)* - This is a pencil sketch of the gatehouse and hall and there are no changes to the features depicted. The Astronomical Clock is not shown suggesting it had been removed, possibly for repair, at this time. There is a suggestion of diaperwork at the top of the turrets.

10.2.14 *Anon. 'Hampton Court Palace' (c.1830)* - This is another pencil sketch depicting the gatehouse. There are no new details to the elevation as the two clocks remain however, there appears to be fixtures (probably for lamps) fixed to the base of the turrets adjacent to the archway. What appears to be a chimney pot can be seen

through the crenelations of the south west turret suggesting the chimney stack was inserted earlier than previously thought.

10.2.15 *Anthony Salvin (1831)* - In this rough sketch of the east elevation the single storey porch and the iron coat of arms for Henry VIII are still in situ. There are no other changes to this elevation visible.

10.2.16 *Philip Hardwick 'Clock Court with Hall' (c. 1831-40)* - In this image we can clearly see the south elevation which has no chimney and the casement window for the clock room is also not depicted. It is likely these have been omitted for clarity. The single storey porch has apparently been removed and the iron coat of arms of Henry VIII remains, covering the Wolsey terracotta arms.

10.2.17 *The Penny Magazine 'Middle quadrangle of the Palace of Hampton Court'(1834)* - This image is interesting as it shows the two clocks on the Base Court elevation removed and replaced by boards.

10.2.18 *John C Buckler 'The Hall of Hampton Court' (c.1837)* - The angle of the image means we can see little detail of the gatehouse. The single storey porch is not in situ suggesting its removal was sometime between 1831 and 1837.

10.3 Archaeological Investigations

Terracotta Roundels

10.3.1 Removal of the lead plaques beneath the terracotta roundels revealed four different phases of brick and mortar beneath. Since it is thought that the roundels were set in situ on the gatehouse around 1771/2, and the plaques are depicted in a drawing by John Spyers in 1780, we can assume that the brickwork beneath is that seen on the turrets at this time. The painted surfaces beneath the plaques were sampled and analysed by Catherine Hassall (Appendix II).

10.3.2 Augustus (NE Turret) – Red painted plaster, completely covering the brickwork as well as the mortar joint, which has fake joints painted on with white paint. This was possibly done to repair the brickwork beneath, however the reason remains unclear. This roundel differs to the others as it is glazed and has a different form of fixing and its origin in unknown. It appears to be a companion to the female roundel currently held in storage. This roundel, known as 'Augusta', is thought to have been brought to Hampton Court by Edward Jesse in 1845 along with two roundels which are now fixed to the Great Gatehouse suggesting Augustus was placed in position on the NE turret around this time.

10.3.3 Vitellius (SE Turret) – Double struck mortar joint with ruddling traces on mortar and bricks as discussed in section 4.2.6. Analysis by Catherine Hassall has identified the paint mix as very similar to that seen on the Chapel Royal east wall which is Wolsey in date.

10.3.4 Trajan (NW Turret) – Finely gauged brickwork with penny rolled lime mortar as

discussed in section 8.3.16. This brickwork probably dates to the early 18th century removal of the bells and the structural rebuilding of this turret.

10.3.5 Hadrian (SW Turret) – Red painted plaster patches over parts of brick and mortar with black painted pointing. Analysis of the paintwork produced no conclusive date but the use of lead white to the black carbon colour gives a date later than the 16th century and before the late 19th century.

Replacement of lead and boards on cupola and lantern

10.3.6 Examination of the leadwork on the cupola and lantern showed there were several different types of fixing. A more regular flat headed nail was used on the cupola leadwork compared to the majority of the lantern leadwork above. The lower section of the lantern was mostly covered with early 18th century lead but there were some areas which appeared to have been replaced, probably as part of the this phase of works.

10.3.7 During removal of leadwork on the lantern it became clear that many pieces of the wooden capital and skirting were replacement timbers, the original being oak and the replacement all of softwood. There were also two types of moulded footing which sat beneath the decorative scroll on the lower section of the lantern. The lead for the capital and skirting had been rolled around the timber and then fixed in position with nails.

10.3.8 Removal of the cupola leadwork revealed numerous examples of graffiti which were dated 1827 (See also Appendix IV). The most prominent was located on a sarking board forming a rib of the cupola. This was clearly inscribed '*T Thorpe 1827 Plumber'* and has probably been cut with a knife as the writing was very stylised. Other dated graffiti included *'Thomas Taylor Plumber aged 30 Robert King Carpenter age 57 William Taylor alias Totsey age 29 1827'* which was inscribed on the underside of cupola leadwork. Another less decipherable inscription is *'Thise gutters was layd by Harry Ba[-----]d livd at Hampton & is 42 years of a[ge] & Alan Conel[---] lived at Kingston & [is] 24 July 12 1827'* which was written in pencil on the upper face of a valley sarking board. As well as lead replacement there was extensive replacement of the 18th century sarking boards of the cupola and valley.

Paint Analysis of cupola and lantern

10.3.9 After analysis by Catherine Hassall it was seen that the painted surface of the lead had been painted on the inside and outside with off white/stone coloured paint. The paint was lead based with iron oxides for tinting of colour. In total there were six layers of internal painting and seven layers of external painting for all of the 19th century. There are several schemes for the re-gilding of the finial but it is difficult to determine the exact date for these, and so they may be part of an earlier phase.

11 PERIOD 9: C.1838 - 1912 (PUBLIC PALACE)

11.1 Documentary Sources

11.1.1 In 1839 the clock was overhauled by BL Vulliamy (WORK 19/525; Heath XIX) and in 1879 a new mechanism was commissioned from Gillett and Bland (WORK 19/525; Heath XIX).

11.1.2 In 1845 the Henry VIII iron coat of arms, which had been inserted over the Wolsey terracotta coat of arms in 1531, was removed for restoration. The Wolsey arms are described by Edward Jesse in an issue of 'The Gentleman Magazine' December 1845:

'When King Henry the Eighth took possession of Wolsey's noble palace at Hampton … his arms were placed over those of the Cardinal in the centre court. These were of terracotta, portions of which were cut away for the purpose of inserting the arms of the king, which were carved out of the fire-stone, or that peculiar grey stone then much used. The royal supporters were place very ingeniously between those of the Cardinal; and, to conceal everything belonging to that prelate, the hat was covered by a crown worked in wrought iron…The monogram of Henry, and the date, covered the initials and date of Wolsey's, and the King's motto concealed the favourite one of the Cardinal, DOMINUS MICHI ADIUTOR. This last was cut in stone, while that of Henry was in leadwork.'

11.1.3 Apartment 30 continued to be occupied by grace and favour residents including Lady Augusta Pagett, resident from 1840 until her move to Apartment 40 in 1841, and Lady Cecil Gordon from 1872 until 1902. Lady Keyes occupied the apartment from 1902 until 1916.

11.2 Pictorial Evidence

11.2.1 *Anon. 'Archway and steps leading to Wolsey's Hall, Hampton Court' (1839)* - This sketch depicts the Anne Boleyn gateway arch and vault in detail prior to restoration by Lessels in 1880. The interior facing appears to be of stone.

11.2.2 *1846 - Anon. 'East range of Base Court' (1846)* - There is no new detail shown in this sketch. The two clocks are unclear.

11.2.3 *Edwin Edwards 'East range of Base Court'(1862)* - This sketch shows the monogram and clock from St Jame's Palace in situ on the Gatehouse.

11.2.4 *East range of Base Court (Photograph c. 1860-70) and Base Court (Photograph c. 1870)* - These photographs clearly show the inserted glazed bricks on the lower two sections of the north west turret (Plate 6). The window in the south elevation can be seen, although not in detail. What appears to be a chimney pot can be seen through the crenellations of the south west turret indicating the chimney stack was inserted possibly a decade earlier than previously thought (Statement of Significance). Both images show the c.1700 surface of Base Court.

11.2.5 *Western range of Clock Court (Photograph c. 1870-80?)* - This is the earliest photograph of this elevation. The repaired brickwork following the removal of the single storey porch can be seen as well as the chimney stack and window on the south elevation. The coat of arms depicted are the terracotta arms of Wolsey.

11.2.6 *East range of Base Court and surfaces (Stereoscopic photographs c.1870-90)* - This pair of photographs also show the difference in brickwork on the north west turret lower section, the chimney on the south elevation and the clock and monogram from St Jame's Palace. The casement windows of the oriel window are open indicating occupancy of the rooms (Plate 7).

11.2.7 *Anon. (after Lyons 1800) The first court with cupolas restored (c. 1885)* - This image appears to be a proposal for the renewal of the onion roofs to the turrets within Base Court.

11.2.8 *East Range of Base Court (Photograph 1889)* - This damaged photograph clearly shows the St Jame's clock and monogram.

11.2.9 *Anne Boleyn Gatehouse (Photograph Pre 1891)* - The exact date for this photograph is unknown but it does have the c. 1700 surface in Base Court.

11.2.10 *East Range of Base Court (Photographic postcard Pre 1891)* - This postcard also shows the gatehouse prior to the resurfacing of Base Court. A workman with a wheelbarrow can be seen lifting setts on the paving in the northern half of the courtyard.

11.2.11 *Photograph of Anne Boleyn Gatehouse (Photographic postcard c.1900)* - This postcard shows the gatehouse after the turfing of the Base Court surface. No other features of note are shown in this image.

11.3 Archaeological Investigations

Chimney Adjacent to NW Turret

11.3.1 It was thought that the replacement of the chimney adjacent to the NW turret was amongst various works in the 1880s, however, graffiti was discovered on a cut brick forming part of the upper chimney decoration, the inscription reads: *'GP Dec 11 1844'* which confirms that this work was part of earlier 19th century repairs (See also Appendix IV). The bricks have been identified as Type T on the Hampton Court Brick Typology, however some bricks are distinctly darker in colour and it is suggested that the T bricks are part of a later rebuild. The chimney was remortared with a mortar similar to the 1960s mix seen with modern straw brick repairs so the original bedding mortar and pointing cannot be seen.

Cosmetic changes to the lower NW turret

11.3.2 It likely that the refacing works to the NW turret mentioned in the statement of significance relates to cosmetic changes to the existing 18th century brickwork as

opposed to the refacing of the majority of the lower turret with Type T bricks. The lower brickwork of the NW turret has been raked back, with the visible arrises removed to enlarge the area for pointing, and thick black ash pointing added. Glazed bricks were also inserted using black ash mortar. The addition of black ash mortar to the elevation was a clear attempt to blend the brickwork with adjacent discoloured brickwork. The earliest clear depiction of the cosmetic changes to the turret is a photograph which was probably taken c. 1880 (Plate 6).

Refacing of NW and SW turrets

11.3.3 It is likely that a central part of the NW turret and the majority of the SW turret were refaced in Type V bricks during this phase. The brick type is generally made up of a mix of different type bricks; however the distinctive particles of orange clay can clearly be seen throughout these sections of the gatehouse. The bricks are orange/rose/brown coloured and measure 52-58 x 225-235 x 105-125mm which does fit with the typology measurement, however the arris-to-arris measurement on the typology is stated as (270mm) and the recorded measurement of 255-273mm is less regular, suggesting the brickwork was possibly laid to match the adjacent brickwork. During this phase repairs were also carried out to the NW turret plinth using Type T red stock bricks.

Replacement of stonework

11.3.4 The 19th century works included extensive refenestration throughout the palace. This was generally undertaken in Bath Stone and we can see the use of Bath stone in many areas including the decorative panels of the oriel window, arrow loop windows on the west elevation, NW turret plinth, and the NE and SE turret crenelations. The stone course below the crenelations on the NE turret is also of Bath Stone and includes two pieces of reused stone. These stones are hidden within the turret and the stone type was not identified at the time of survey.

11.3.5 The steps of the doorway leading to the SE turret are of Portland Stone and were probably inserted following the removal of the adjacent porch sometime between 1800 and 1852.

11.3.6 Two granite bollards either side of the archway on the east elevation probably date to the phase and are of a similar material to that used in repaving the Base Court carriageway during this phase (Sanderson 2008).

Refacing of gatehouse interior and replacement of stone vault

11.3.7 The works of John Lessels included the replacement of the stone vault within the gateway with a copy made of Bath Stone. The interior faces of the exposed walls were refaced with Type T bricks and thick black ash mortar. Painted diaperwork was also added to the brickwork at this time.

Paint Analysis

11.3.8 The slate clock has a layer of gilding with clear oil size which indicates this gilding was applied after the mid 19th century (Hassall 2008b, 1). The astronomical clock innermost dial had several layers of nineteenth century paint schemes (Hassall 2008a). The pigment used is French ultramarine blue which had been invented in 1828 suggesting some, if not all, of these layers date to this phase. The lantern continued to be painted inside and out, with off white and stone coloured paints, at various intervals (Hassall 2008c, 4).

11.3.9 There are traces of painted diaperwork on the upper part of the east elevation of the gatehouse and in particular on the SW turret. Analysis of the paintwork by C Hassall (Appendix II) has revealed that the paintwork consists of four distinct layers of paint: two white, one grey and one black. The medium was identified as an oil based size and the colours were formed using lead white and charcoal black. Analysis of the paintwork beneath the lead plaques and of the early 16th century painted diaperwork on the external east wall of the chapel did not match the painted diaperwork from the gatehouse. It is therefore assumed that the painted diaperwork seen on this elevation is later in date and probably part of the re-Tudorization of the Palace in the late 19th century. Painted diaperwork dating from this phase is also seen on the north facing elevation of Chapel Court where a red wash was applied over the mortar of the windows inserted in 1894 (OA 2007). It is interesting to see that the west elevation did not have painted diaperwork added during this phase, possibly due to lack of surviving Tudor diaperwork on this elevation.

12 PERIOD 10: 1912 - 1986 (20TH CENTURY PALACE)

12.1 Documentary Sources

12.1.1 Grace and favour occupation continued within the clock tower (Apartment 30) until 1957. Mrs Alice Madden occupied the apartment between 1916 and 1924, followed by Mrs Evelyn Galloway from 1925 to 1934. Apartment 30 was granted to Mrs Caroline Offley Shore in 1935. The apartment was found to have dry rot, crumbing stone and 'other effects of age' and it wasn't until 1938 following, presumably extensive, repair and decoration works that Mrs Offley Shore took residence. She described her accommodation thus: 'In 1935 His Majesty George V gave the apartment in the Clock Tower, Hampton Court Palace…I came here May 10 1938 to live in this most lovely part of this loveliest of old Palaces.' (Parker 2005, 82).

12.1.2 There are two phases of repairs to the Astronomical Clock. The first in 1947 included an overhaul of the mechanism as well as the addition/replacement of the chapter rings. The second phase of repair in 1959/60 included the repainting of the dials as well as an overhaul of the mechanism by Thwaites and Reed. There are some records of the 1960s stabilization of the upper parts of the gatehouse but this is generally poorly recorded.

12.2 Pictorial Evidence

12.2.1 *East range of Base Court (during repair work to the Great Hall) (Photographic postcard c. 1922-24)* - This postcard has been coloured and the terracotta roundels are shown cream in colour. There are several press images showing the reinstatement of the Astronomical clock following the restoration work of 1959/60 (Getty website) which were not included in the statement of significance. They are however available to view online and the details are listed within Appendix I.

12.3 Archaeological Investigations

1960s brick refacing and repairs

12.3.1 The 1960s repairs to the brickwork is easily identifiable by the use of 'modern' bricks with straw impressions and the associated mortar which is hard and has a large quantity of small mixed pebbles. The measurements taken (52-59 x 212-218 x 101-104mm) are consistent with those recorded on other recent projects in the palace. This modern brickwork has replaced earlier brickwork adjacent to the slate clock on the west elevation and a large patch of refacing on the SE turret. There are numerous other areas of repair using this brick which were probably inserted during stabilization works, c. 1963.

1963 stabilization works to the NW turret

12.3.2 Interior survey of the NW turret revealed many concrete ties inscribed with the date '13-2-63'. These ties occur at various intervals along large, seemingly structural, cracks. The sizes of the ties vary and some are angled to accommodate the curvature of the elevation. For a detailed description of the turret interior see Appendix V.

Stone replacement works

12.3.3 The 1960s repair works also included extensive replacement of stonework on each elevation using Lincolnshire Clipsham type stone. This shelly limestone was used to replace the stone surround of the Astronomical Clock as well as the outer layers of voussoirs, one of which partially cuts the painted stone surround covered by the chapter ring.

Graffiti

12.3.4 There are large quantities of graffiti, probably produced by workmen or palace staff. The majority of these can be seen at the stone doorway providing access from the NE turret to the roof entrance; they were photographically recorded as they were to be left in situ. Several examples were found inscribed on the lead casing of the entrance doorway to the roof and the cupola and lantern leadwork. Examples include '1923 Rowen [or Brown]'; 'John Wegener 1980' and 'Ken Samways Scaff 1978'. Inside the cupola there is an inscription stamped on the end of a timber using a circular gauge 'C.M NO.11 TH L.K 1937 Nov P.J.D'. The lower brickwork

of the gatehouse has been much defaced, probably by visitors including 'DB 1958'; 'Colin Braun' and 'Form 4a' (See also Appendix IV).

Paint Analysis

12.3.5 The paint schemes for this phase are thought to include a lead based pure white scheme followed by two schemes of lead white undercoat and zinc oxide topcoat. During this stage some of the capitals of the lantern posts were stripped of paint and clad in lead before being fixed back on the posts (Hassall 2008c, 4). Finally there are two blue/grey schemes which probably date to the later 20th century and are possibly an attempt to match either the grey undercoat of the early 18th century decoration or the lead on the cupola (Hassall 2008c, 5).

13 PERIOD 11: 1986 - PRESENT (MODERN PALACE)

13.1 Documentary Sources

13.1.1 According to documentary sources there were no major works to the gatehouse during this phase. It is assumed that ongoing repairs and maintenance of the fabric and utilities continued.

14 CONCLUSION

14.1 Key areas of interest identified during the works

14.1.1 *The construction of the cupola* – Although the quotation by Wren for the works exists, there were no records for the date of construction. Graffiti on the sarking board of the lantern cap suggests the construction was near completion in 1711. The unusual design of the ball finial which tops the lantern suggested similarities to the finials at St Pauls Cathedral, however, the use of hollow carved timber as the material of the Hampton Court finial appears to make it a unique example of this type of construction.

14.1.2 *The refacing works to the lower NW turret* – The NW turret originally housed the bells which are now located in the lantern. In 1707 Wren described the turret as being in a ruinous state and requiring shoring to prevent collapse and therefore would have substantially repaired this turret as part of his works. The phase elevations of the brick typology identified the lower brickwork as Type T 19th century bricks, however it is more likely that the brickwork belongs to an earlier date as raking back of the bricks and removal of the terracotta roundel lead plaque, revealed that the bricks were actually laid in a finely gauged manner. The addition of the terracotta roundels to the turrets in around 1771-72 indicates this brickwork was in place by the early 18th century and therefore part of the Wren works of 1707-1711. The bricks were later raked back to allow for thick black ash mortar during the re Tudorisation of the palace in the late 19th century. Analysis of brick measurements did not match either Type T bricks or any other type of bricks identified at Hampton Court, therefore this new brick type should be added to the

Typology.

14.1.3 *The painted surfaces beneath the roundel plaques* – As discussed above the NW turret plaque removal revealed the finely gauged brickwork of the early 18th century refacing. Other plaque removals also revealed interesting painted decoration of the turrets. The NE turret had red painted plaster covering the mortar joints with white painted joint detail. The SE turret provided an example of the Wolsey phase double struck mortar joint with traces of a red wash (ruddling) as seen elsewhere within the palace. Paint analysis showed the similarity of the red wash to that on the painted east wall of the chapel which was constructed by Wolsey. The SW turret had red plaster patches over the mortar joints and partially covering the bricks. Black paint was used to add joints.

14.2 Summary of phasing following investigation

14.2.1 The early 16th century works include the initial construction of the gatehouse by Wolsey between 1514 and 1522 using Type A bricks with some fragmentary diaperwork using vitrified bricks and painted decoration added. The stone dressings were of Reigate and Wheatley stones with some possible use of Caen Stone. Henry VIII works to the palace included the insertion of a grand staircase to his new Great Hall in around 1536 which resulted in the blocking of the NW and NE turret doorways and the installation of a stone vaulted ceiling bearing the initial of Henry and Anne Boleyn. Further changes to the gatehouse upper floors occurred in around 1540 to incorporate the famous Astronomical Clock; the central pitched roof was probably replaced at this time. The later Tudor period saw little changes to the fabric, although the accommodation was in use - graffiti within the room beneath the clock room bears the date 1570. Other, possibly apotropaic, graffiti recorded probably dates to the 17th century.

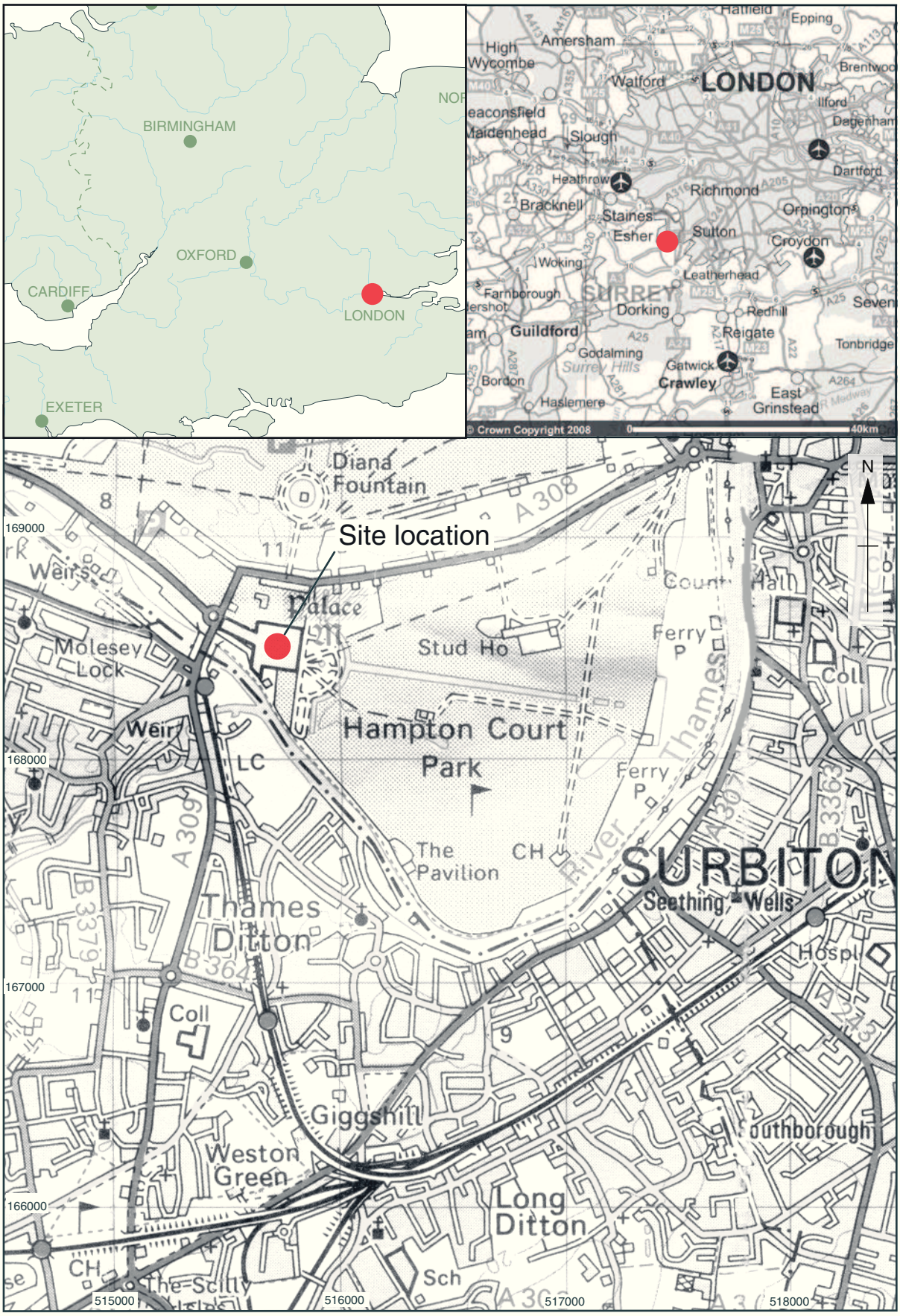
14.2.2 Ongoing repairs to the gatehouse continued until the major works undertaken by Christopher Wren in 1707-11. These works included the refacing of the lower NW turret in a previously unrecorded brick type as well as the addition of extensive internal brickwork to stabilise the turret. The bells were removed from the NW turret and a cupola was constructed on the roof of the gatehouse. The bells were resited within the lantern which sits on top of the cupola and both the lantern and cupola were covered with rolled lead and painted. The four terracotta roundels were added to the turrets of the gatehouse by 1771, where they remain relatively in situ. Beneath the lead name plaques of the roundels are different types of painted decoration which indicate the decorative appearance of the gatehouse at this time.

14.2.3 The 18th and 19th centuries saw the accommodation within the gatehouse used as part of the grace and favour Apartment 30. The 19th century works included refacing of much of the turrets and the re Tudorisation works including the refacing of the great stairs and the replacement of the stone vaulting with an exact replica. Extensive refenestration was undertaken in Bath stone and the gauged brickwork on the lower NW turret was raked back and had glazed bricks and thick black ash

mortar added. A slate clock and monogram was introduced on the west elevation. Ongoing repair works continued in the 20th century and in the 1960s extensive repairs were undertaken to the NW turret using concrete ties placed within the structure to pin structural cracks together. Many areas of patch repairs to the brickwork were carried out using bricks with deep straw impressions. The upper central section of the west elevation was completely refaced with this brick type as well as large sections of the turrets. The stonework surrounding the astronomical clock was replaced with Clipsham Limestone and the clock dials were removed and repainted.

14.2.4 The works of 2007-08 removed much of the black ash mortar and replaced decaying stone and brickwork. The leadwork of the lantern was removed for the first time since 1711 and the revealing detail of the painted decoration. The ball finial uncovered and replaced during the works is possibly of a unique design and therefore of great interest to Wren scholars. The 1827 replacement leadwork was removed and underneath the extent of the repairs to the cupola roof and valley boards could be seen. The releaded cupola and lantern were painted using colours identified as the original decorative scheme following paintwork analysis. The extent of the works allowed many unseen areas of the gatehouse to be seen and thus add to our knowledge of several important phases of the Palace's construction history.

Alison Kelly
Oxford Archaeology
June 2008



Scale 1:25,000

Figure 1: Site location

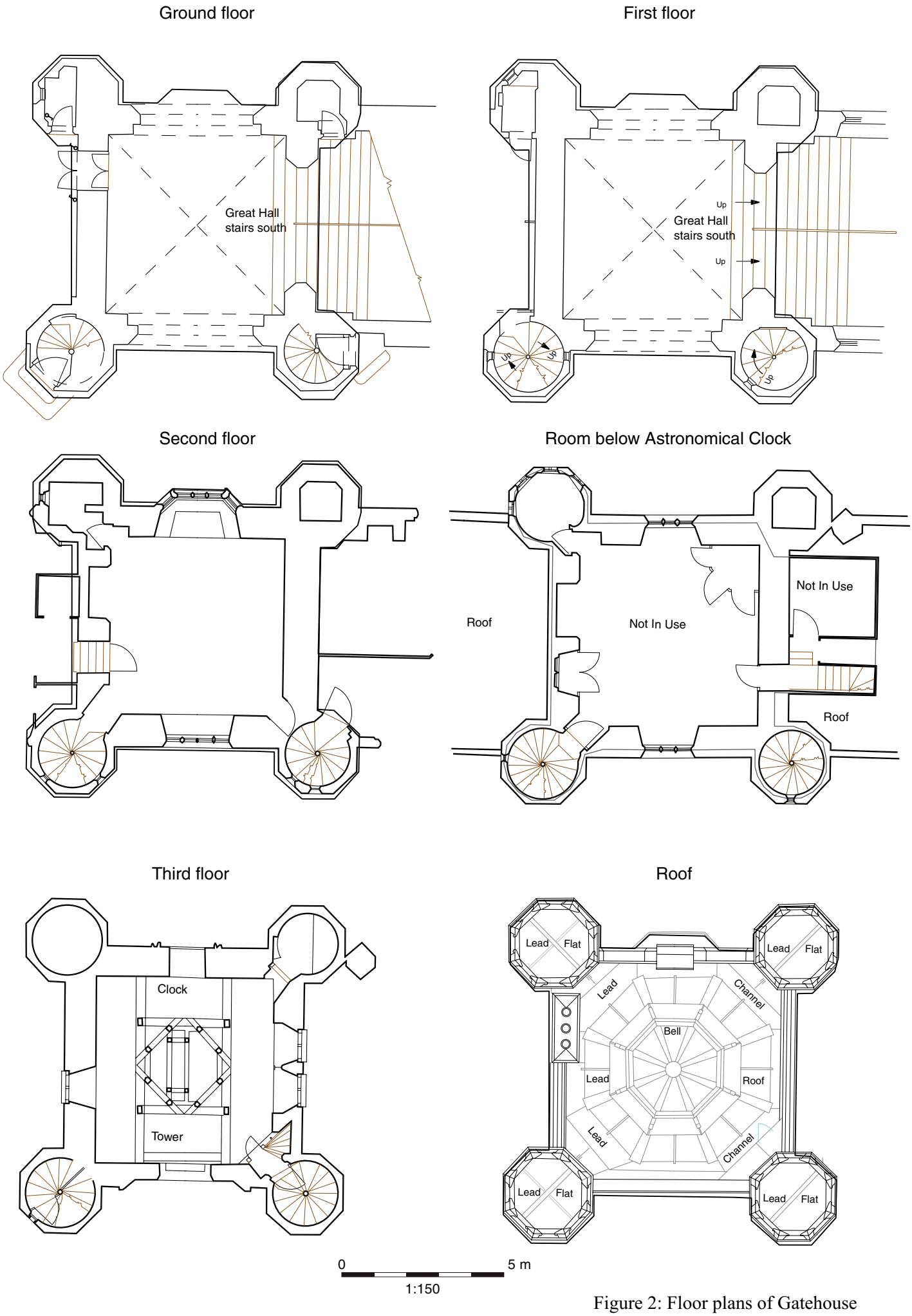
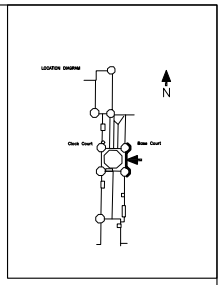
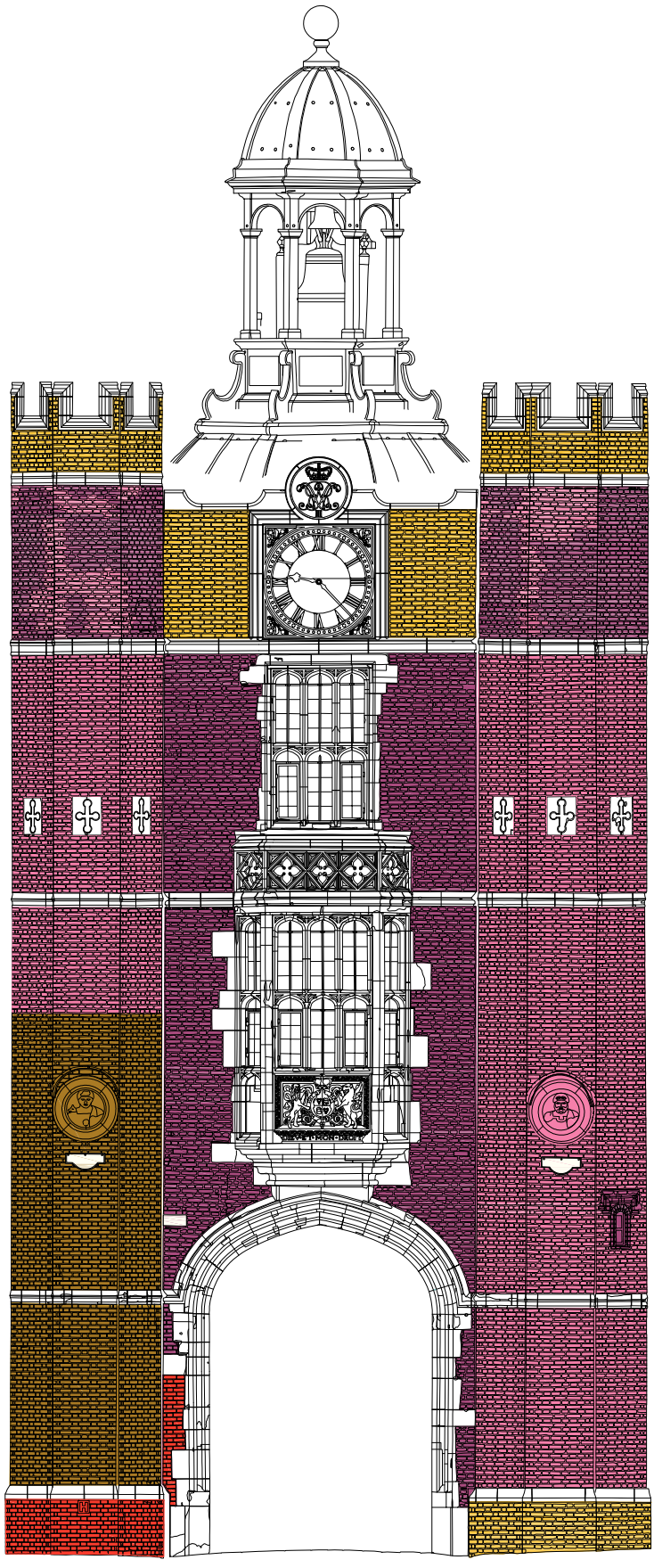


Figure 2: Floor plans of Gatehouse





Type A - Pre Wolsey and Wolsey stock brick (?-1528)

Type T - Red face brick (19th century)

Type V - Stock brick (19th - 20th century)

Modern straw Imprint brick(1950s -1960s repair works)

Unidentified 18th century red stock brick

0 5 m

Scale at A3 1:75

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Figure 3: Anne Boleyn Gatehouse, East Elevation - Brick Types and Phases

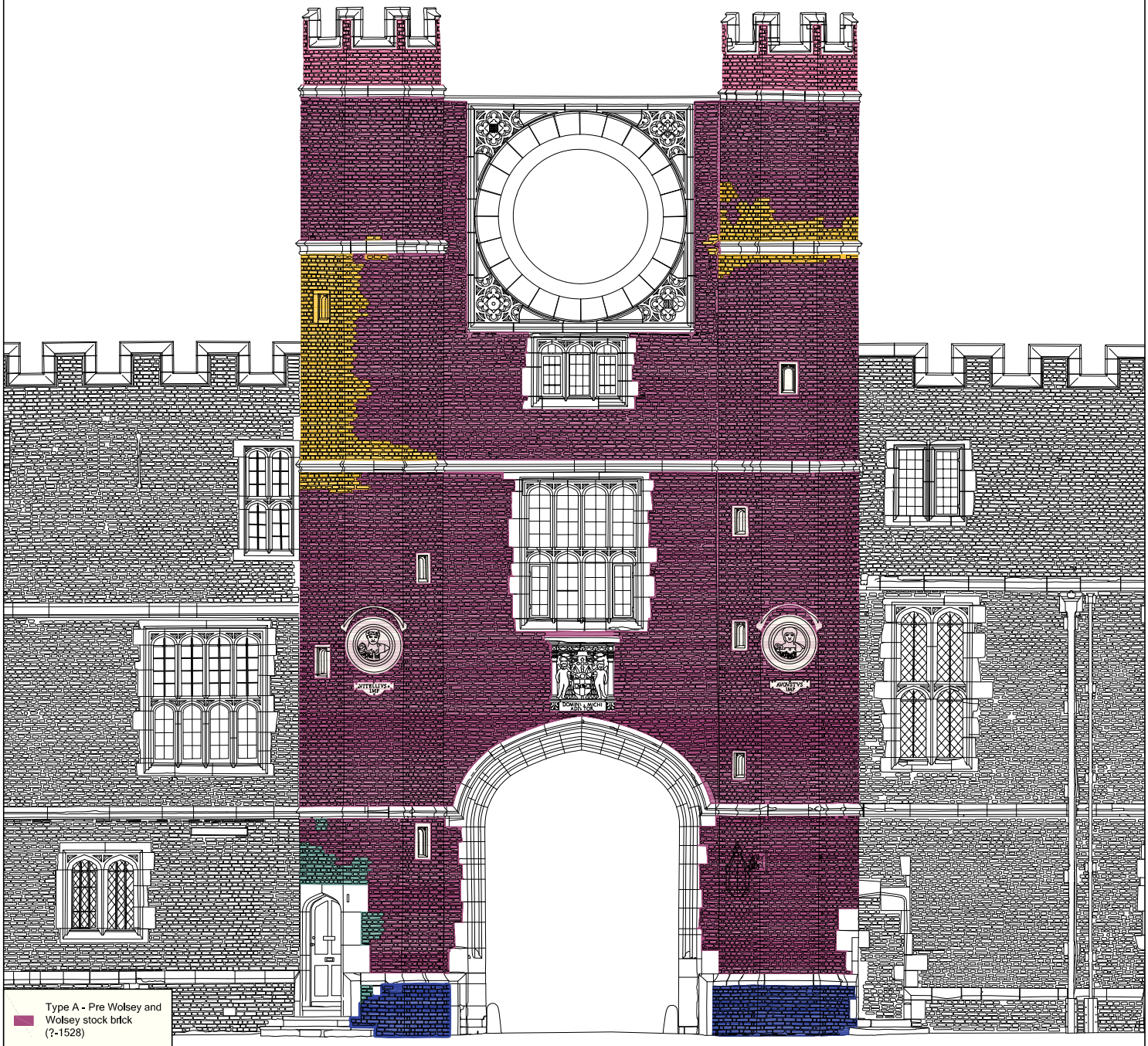

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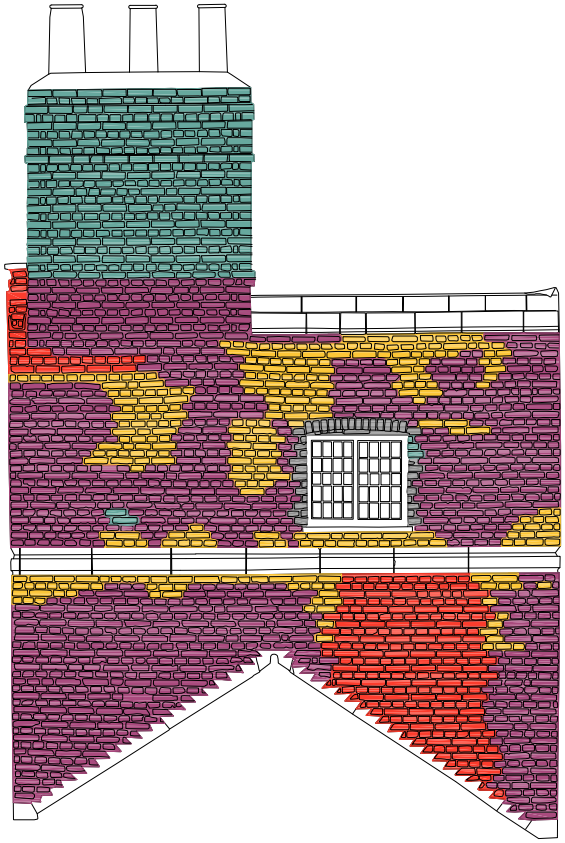
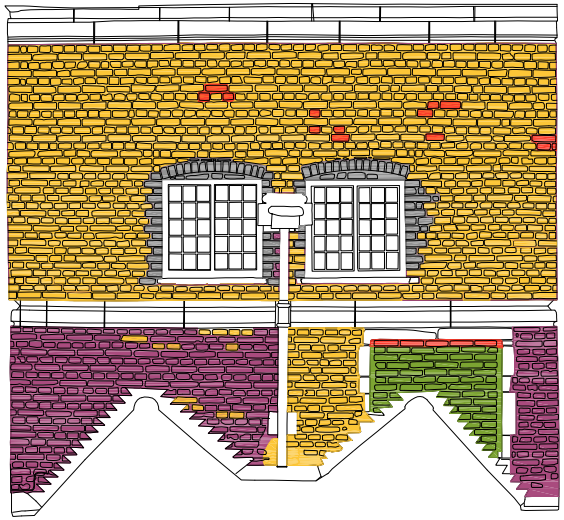
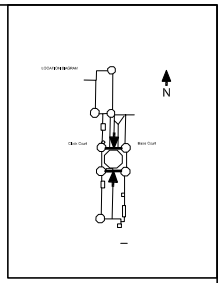
Figure 4: Brick Types and Phases



SOUTH ELEVATION



NORTH ELEVATION



Type A _ Pre Wolsey and Wolsey stock brick (? - 1528)

Type A brick (reset)

Type C _ Henrician stock brick (1529 -1566)

Type Q - Malms, seconds: washed stock (Late 18th - 19th century)

Type T - Red face brick (19th century)

Modern straw Imprint brick (1950s - 1960s repair works)

0 2 m

Scale at A3 1:50

R:\Projects Ongoing\HCP - Base Court (AB Gatehouse) \report\Figures and Plates \Figures\CAD drgs\North and South elevations \HCP59BS_Hampton_Court_Palace_Anne_Boleyn_Gatehouse_North_and_South_Elevations_060809.dwg(Figure 5)***** 28 Aug 2009

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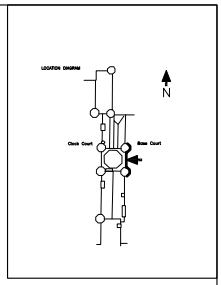
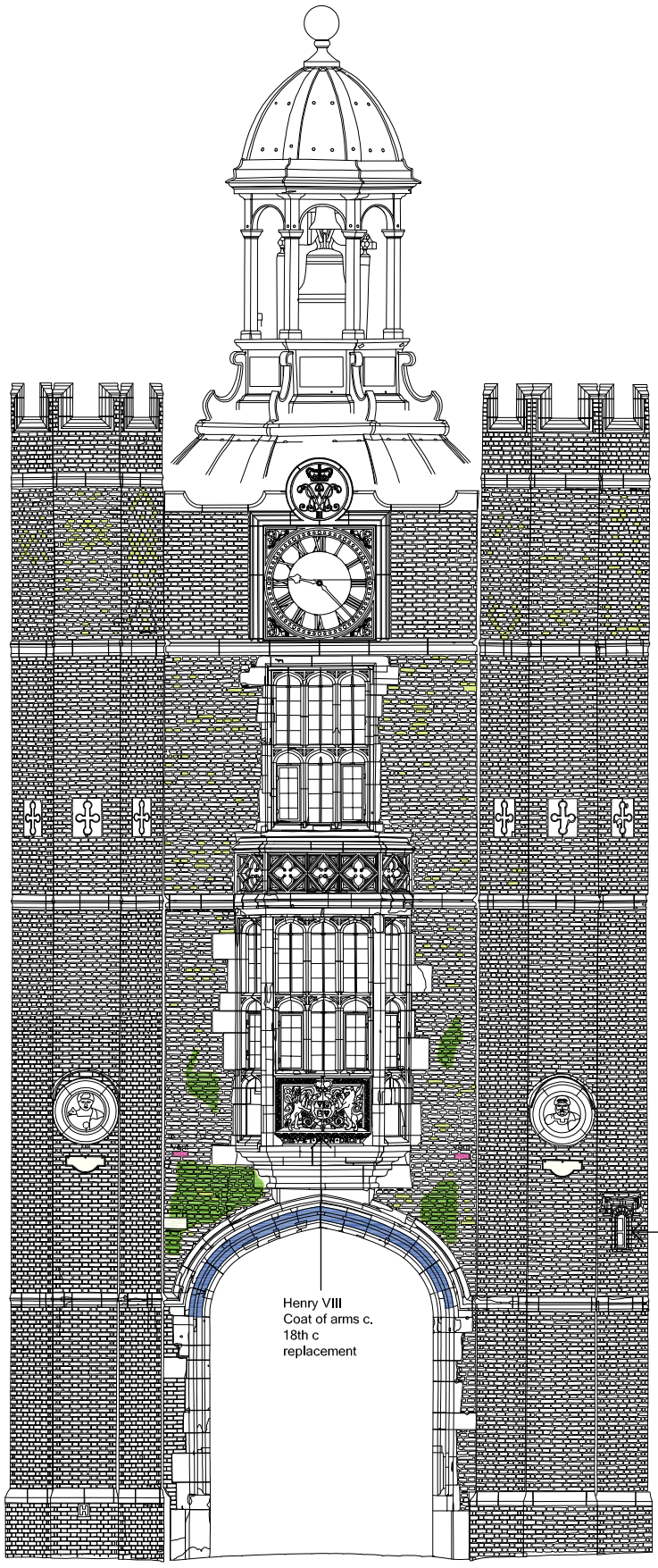
Figure 5: Anne Boleyn Gatehouse, North and South Elevation - Brick Types and Phases





Vitrified brick
Traces of red wash paint
Paint traces
Vent

0 5 m

Scale at A3 1:75

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Figure 6: Anne Boleyn Gatehouse, East Elevation - Diaperwork and other details

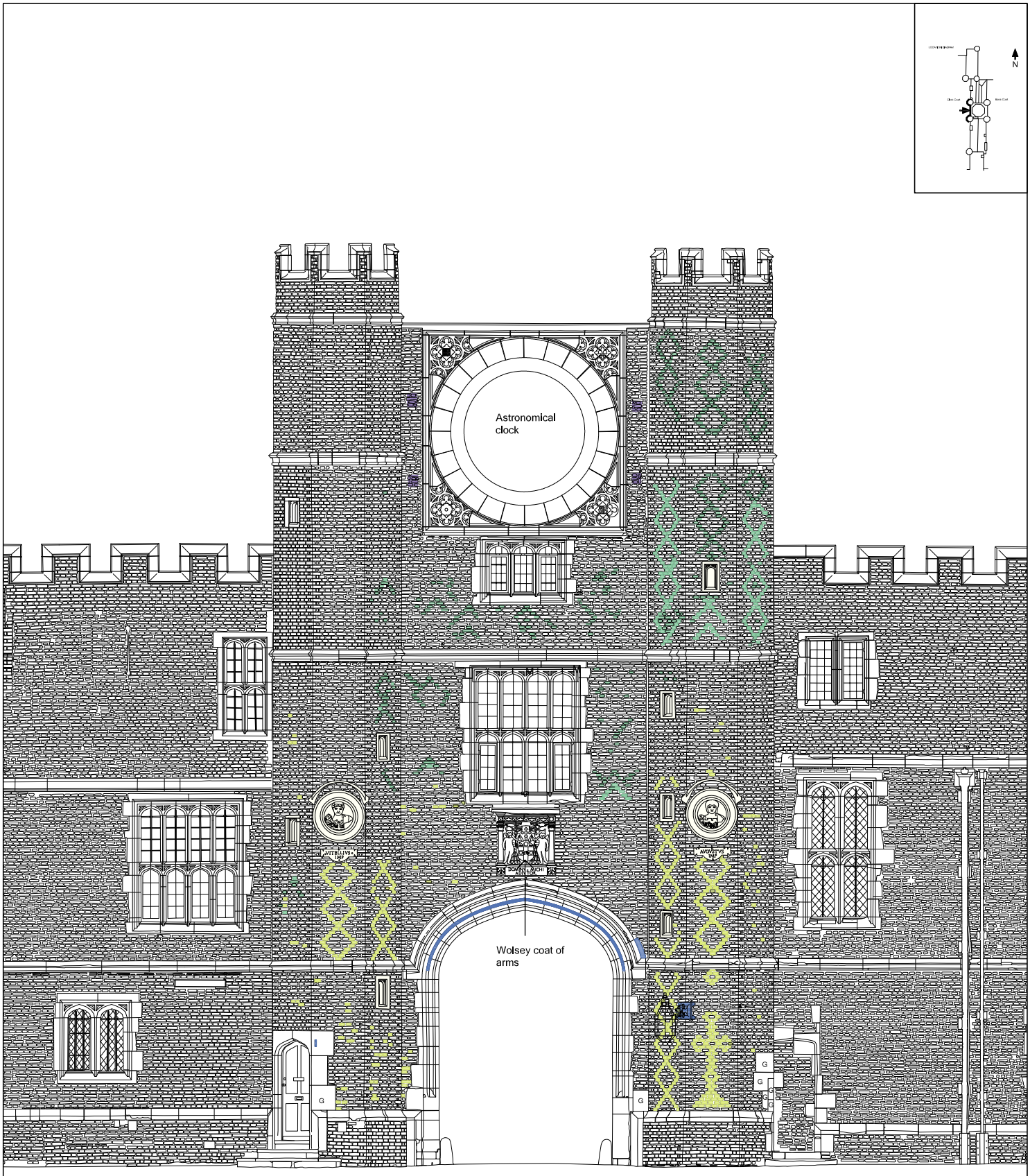

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Figure 7: Anne Boleyn Gatehouse, West Elevation - Diaperwork and other details

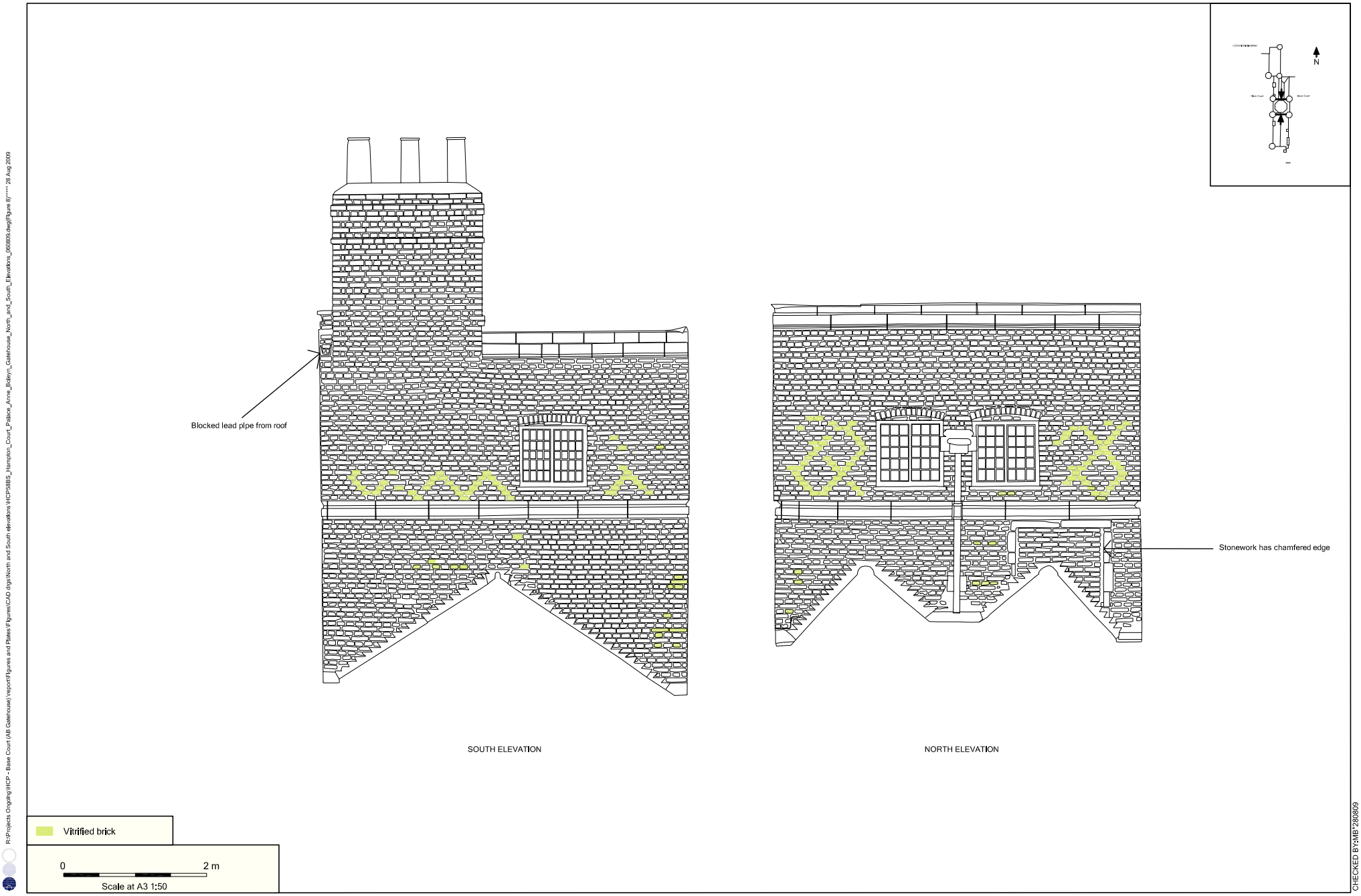

Figure 8: Anne Boleyn Gatehouse, North and South Elevations - Diaperwork and Other Details

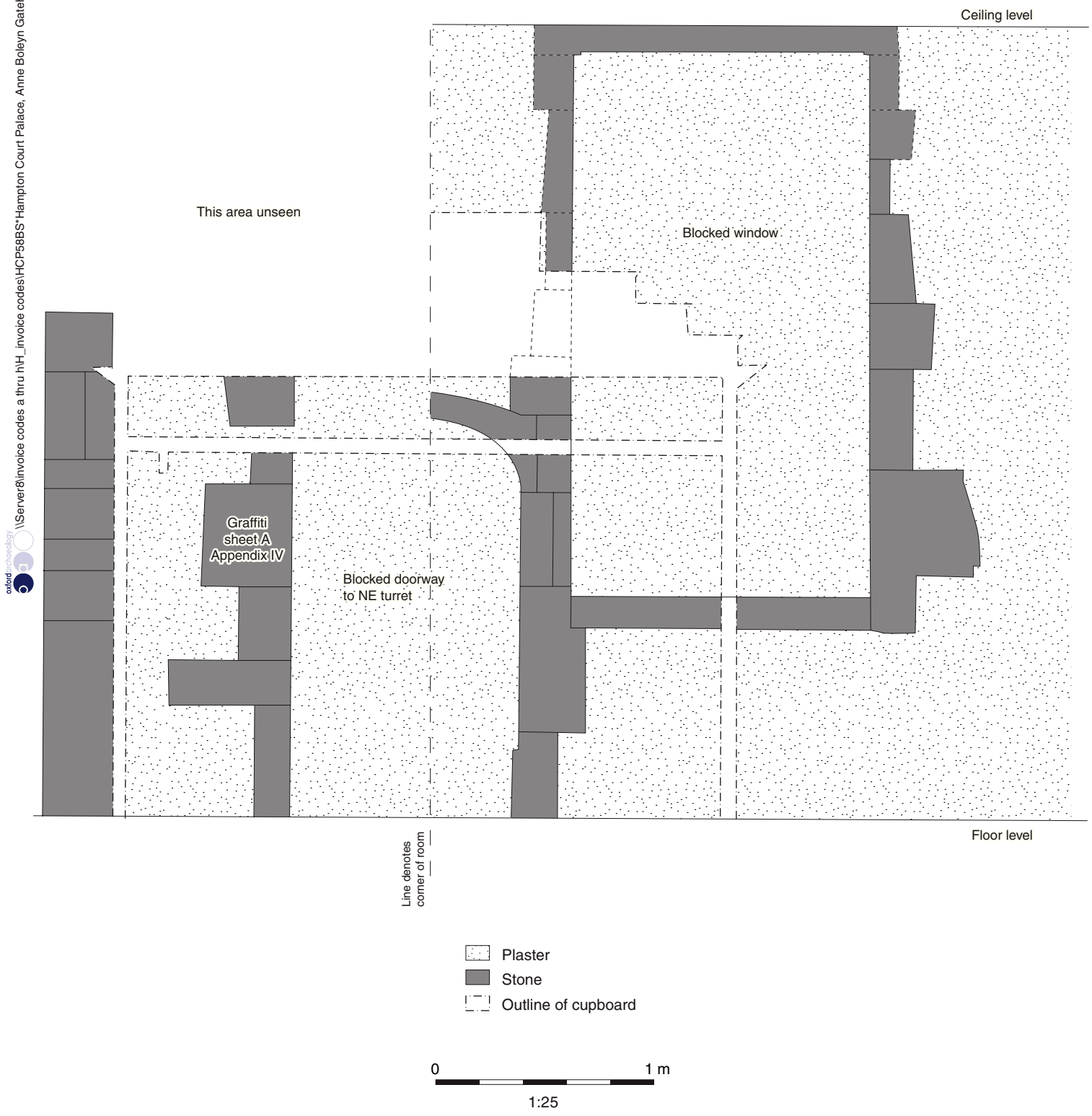

Figure 9: Interior elevation of room beneath clock room showing blocked window and doorway

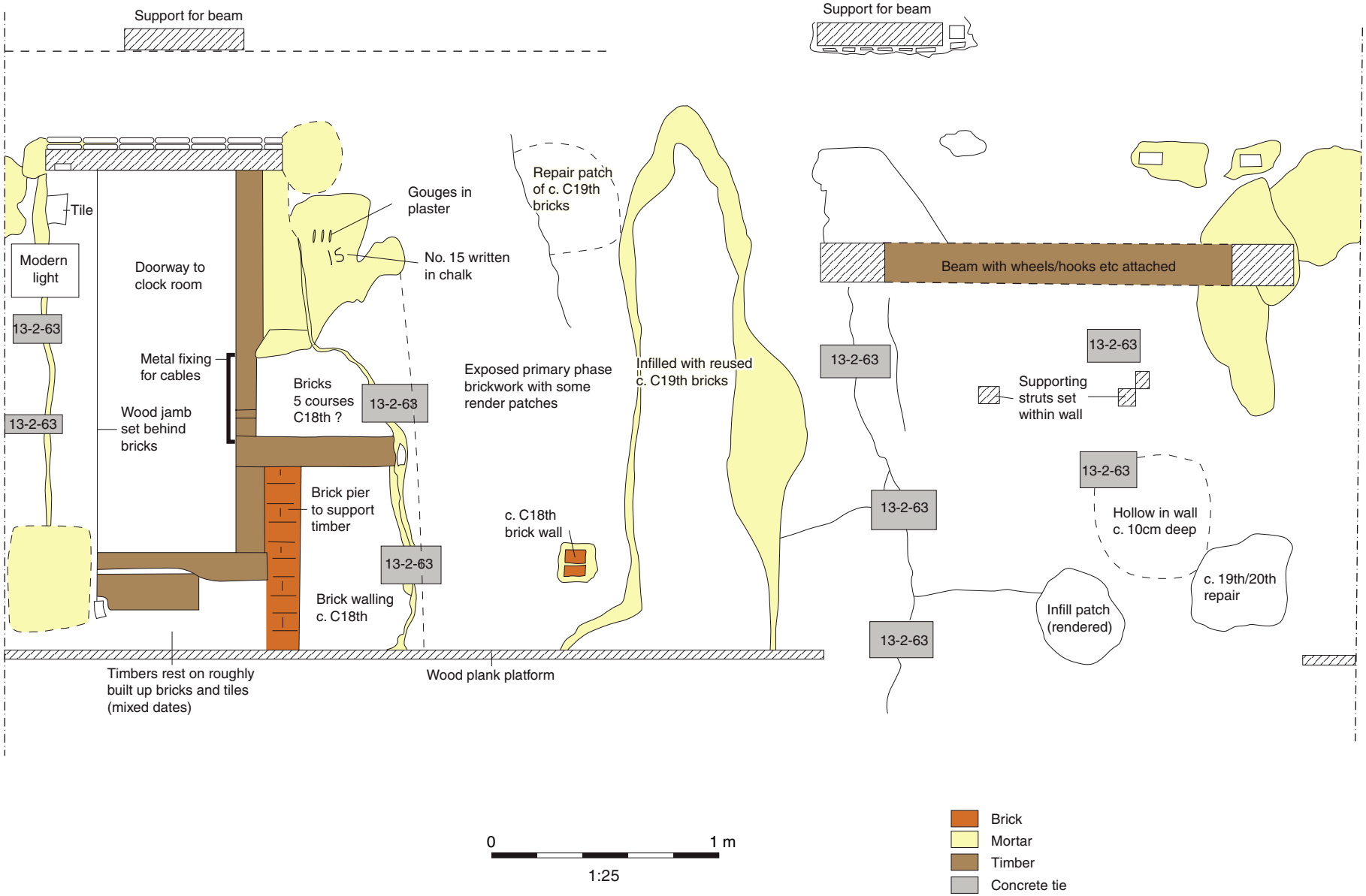

Figure 10: North-west turret - interior elevation of turret adjacent to clock room

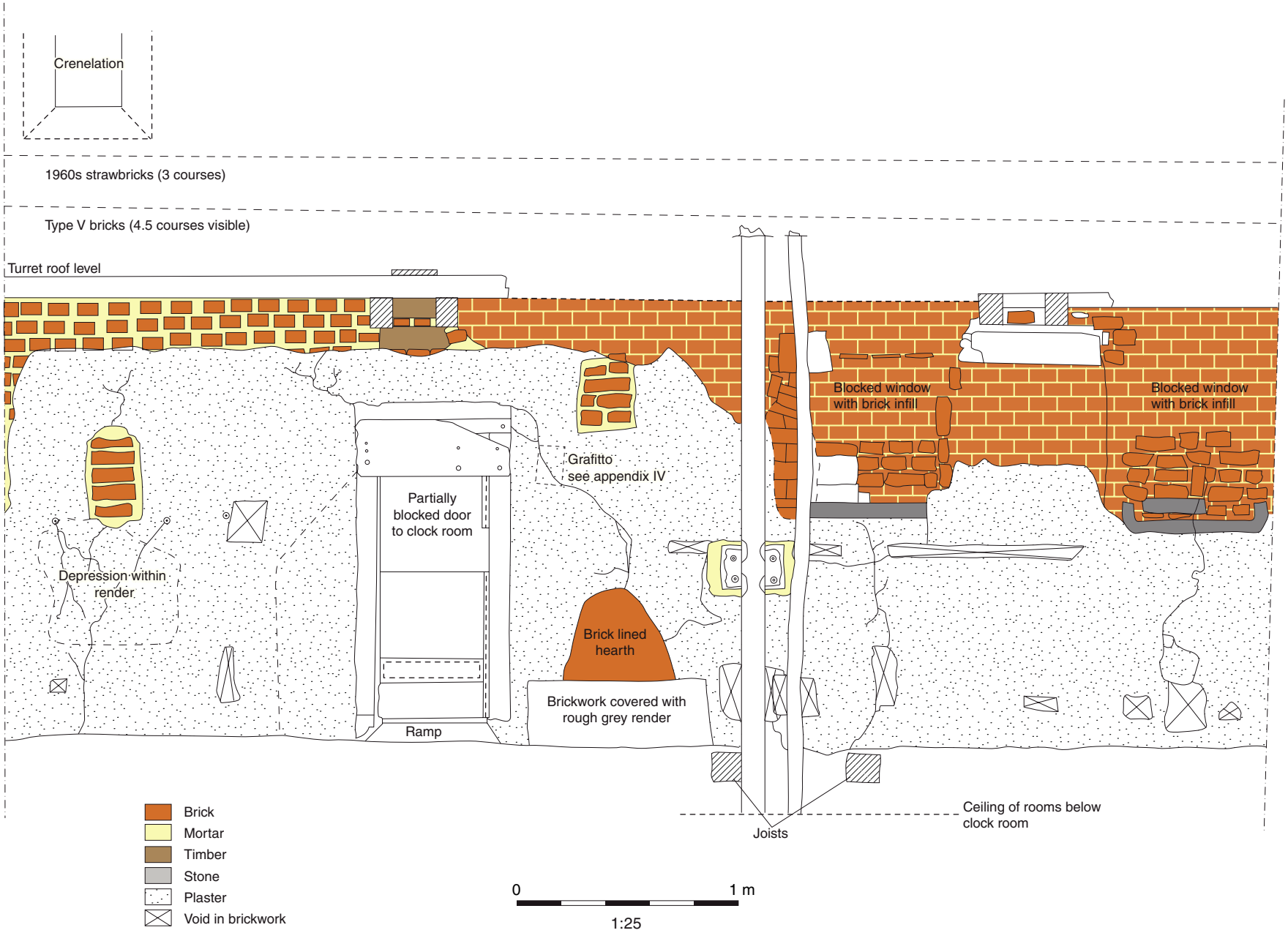

Figure 11: South-west Turret - interior elevation of room adjacent to clock room

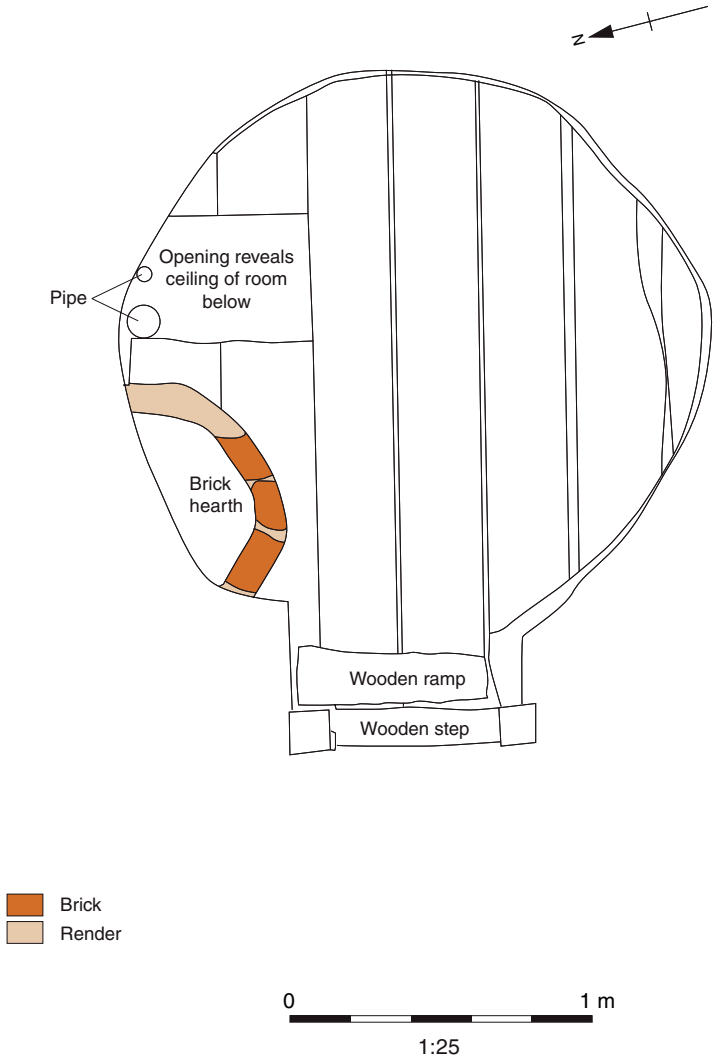

Figure 12: South-west turret - plan of room adjacent to clock tower

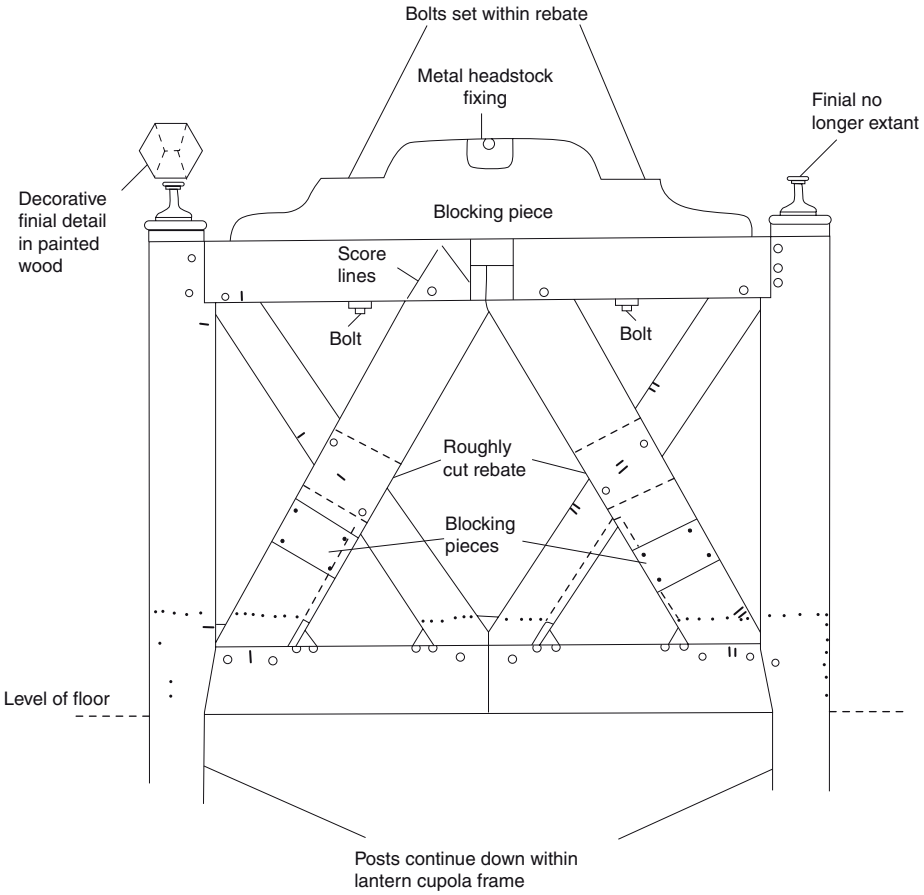

Figure 13: Detail of bell cradle (north facing elevation)

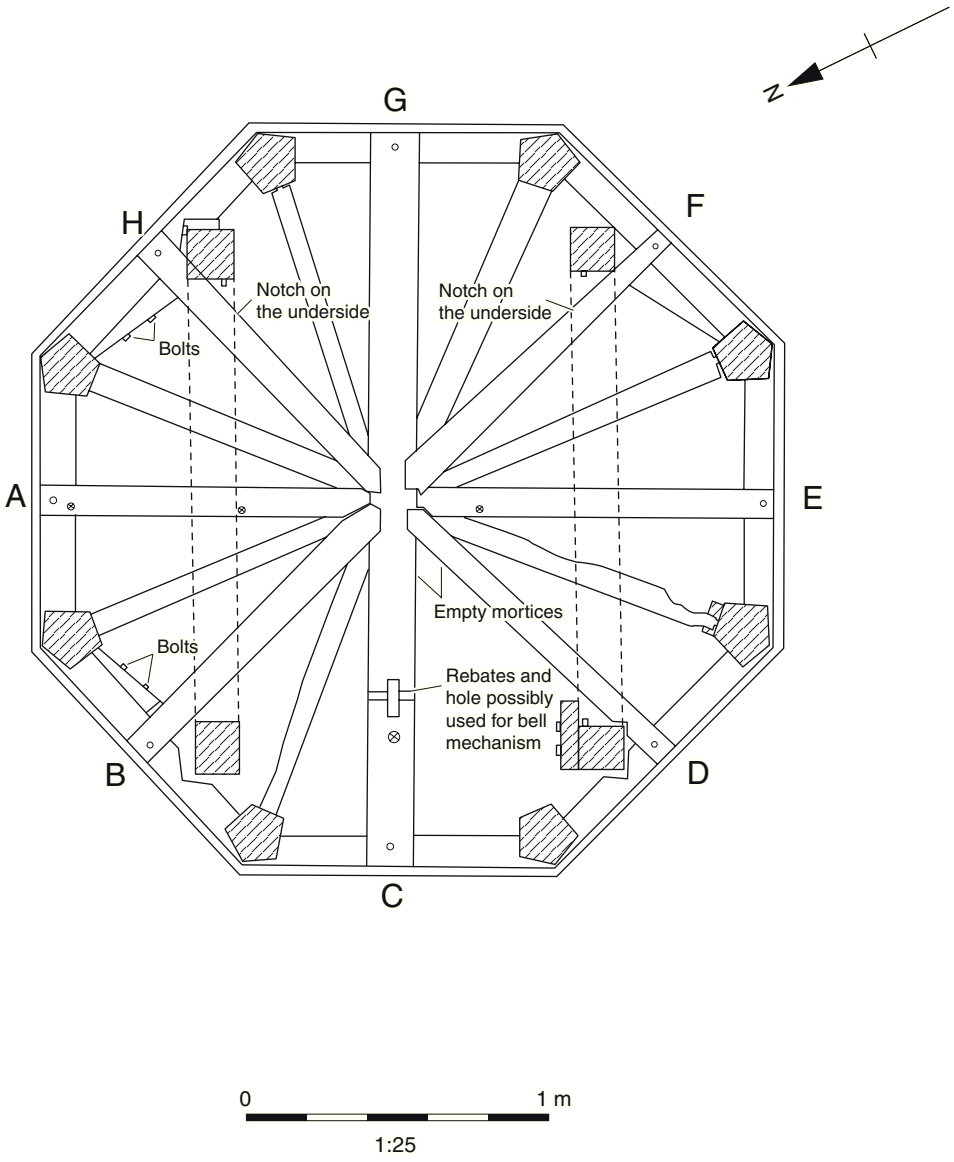

Figure 14: Plan of lantern floor following removal of lead and floorboards

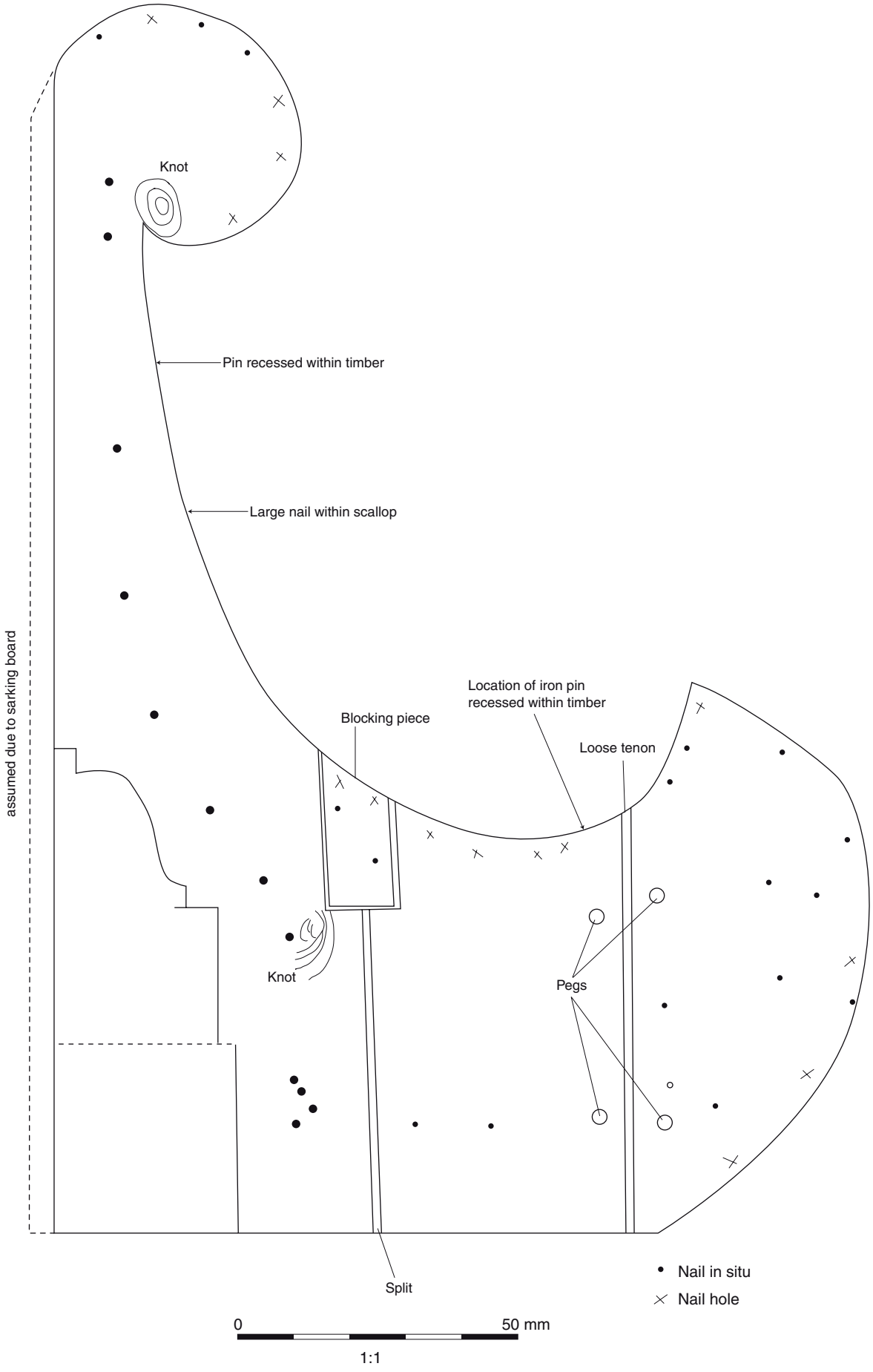

Figure 15: Detail of decorative scroll at base of lantern (south-east facing)

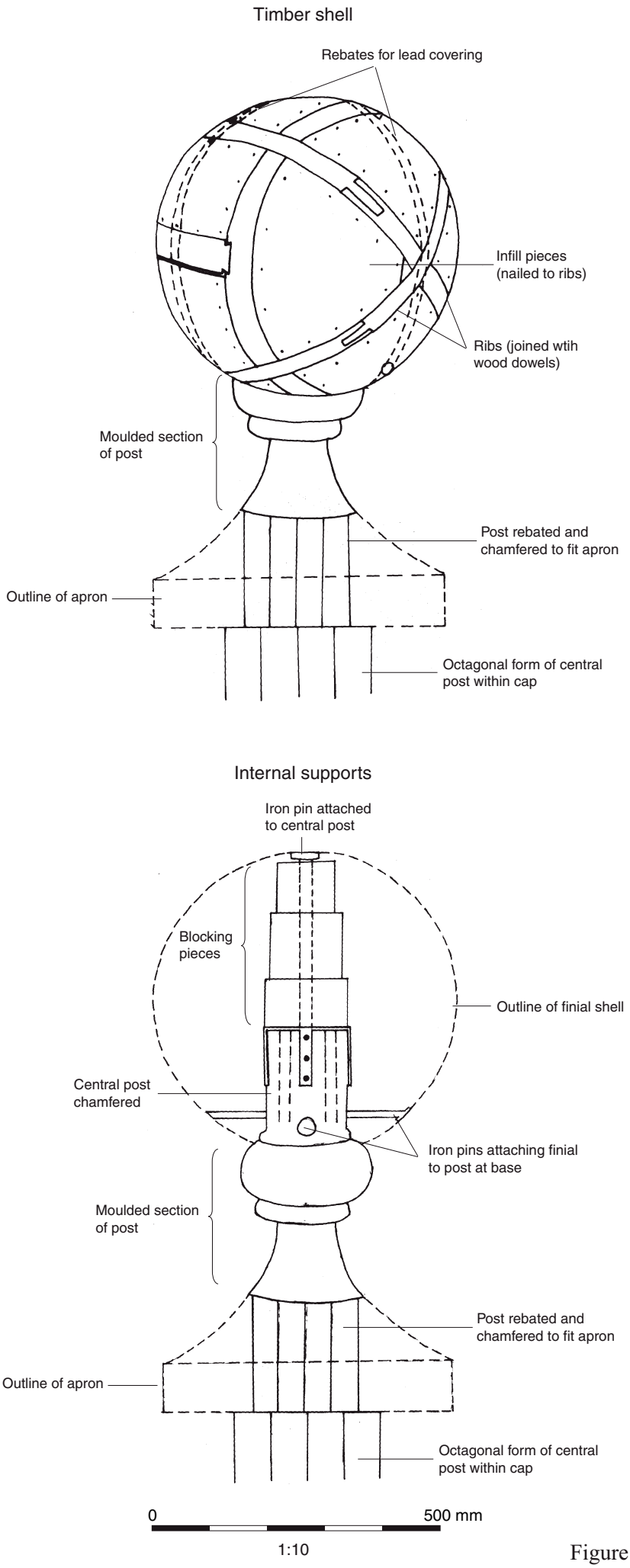

Figure 16: The Ball Finial

Plate 1: Detail of gatehouse from drawing by Anthonis van den Wyngaerde (c.1558) © Ashmolean Museum

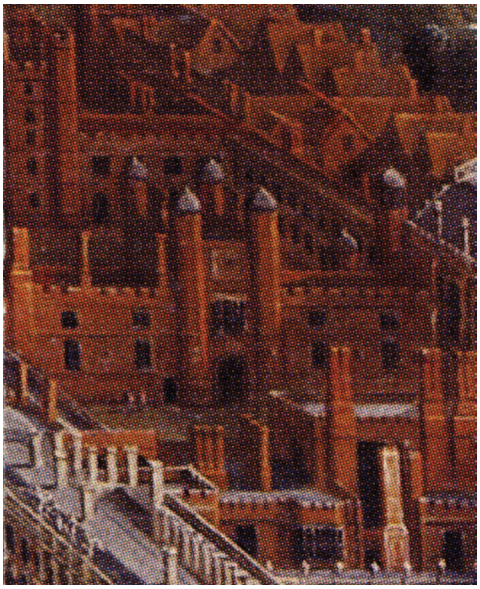

Plate 2: Detail of gatehouse from drawing by Knyff (c.1703) © Royal Collection

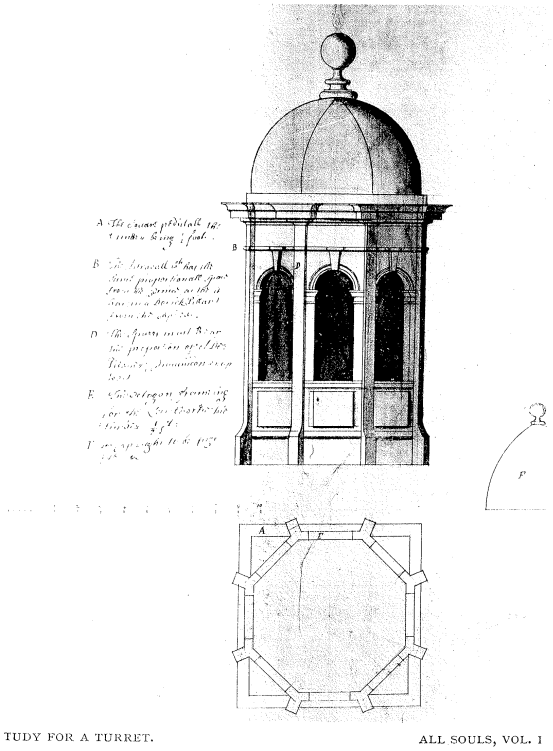

Plate 3: Wren - Study for a turret (Wren Folio Collection)

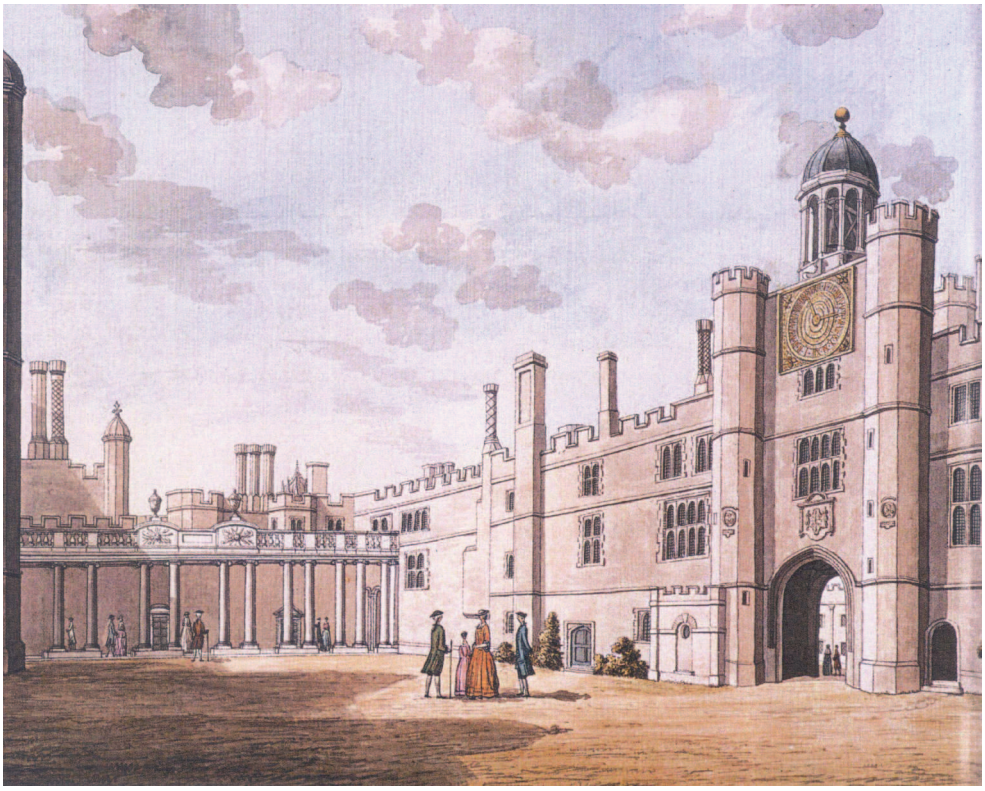

Plate 4: Western Range of Clock Court (c. 1780) by John Spyers © Hermitage

Plate 5: 1st Court Hampton Court (1826) by Emily Rose Prinsep © Orleans House Gallery

Plate 6: Photograph of the East Range of Base Court (c. 1860-70)

Plate 7: Photograph of the Western Range of Clock Court (c.1870-80?)

Plate 8: West elevation of gatehouse prior to works

Plate 9: East elevation of gatehouse prior to works

Plate 10: Founders mark on hour bell

Plate 11: Wolsey Terracotta coat of arms

Plate 12: Moulded brick window

Plate 13: Putlog beside Astronomical clock stonework

Plate 14: Astronomical clock - removal of dial

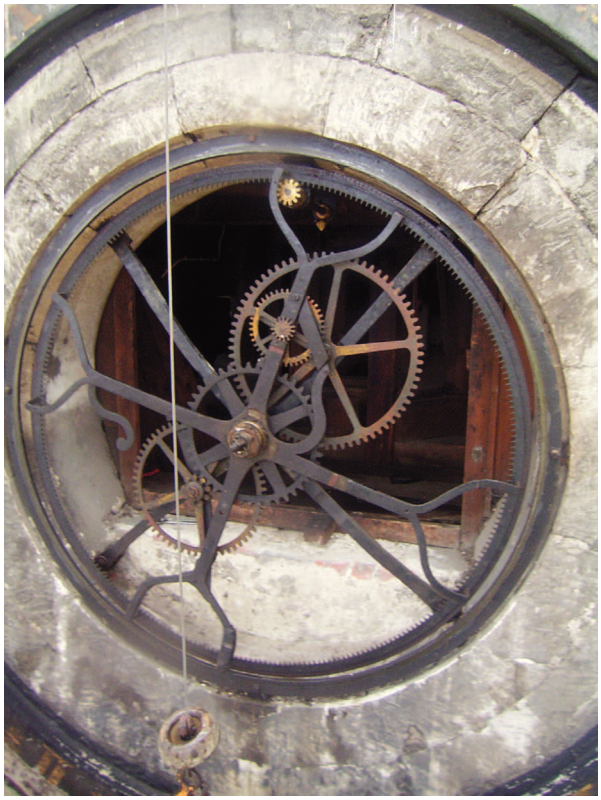

Plate 15: Astronomical clock - Henrician phase stonework hidden beneath dial

Plate 16: Astronomical clock - inscribed detail on Henrician stonework

Plate 17: Astronomical clock - initials and date on spider

Plate 18: Blocked doorway within NE turret

Plate 19: Blocked doorway within NW turret

Plate 20: Henry VIII coat of arms

Plate 21: SW turret interior, blocked window

Plate 22: SW turret interior, blocked window

Plate 23: SW turret interior, nail with lead

Plate 24: SW turret interior, hearth

Plate 25: SE turret exterior, view of doorway hidden beneath cupola valley boards

Plate 26: SE turret interior, view of doorway hidden beneath cupola valley boards

Plate 27: SE turret interior, infilled areas and gouges in render

Plate 28: NW turret, clock weights

Plate 29: NW turret, view up turret from ground level

Plate 30: NW turret, view down turret from second floor level

Plate 31: NW turret, pulleys and other fixtures relating to clock weights

Plate 32: Room beneath clock room, blocked window

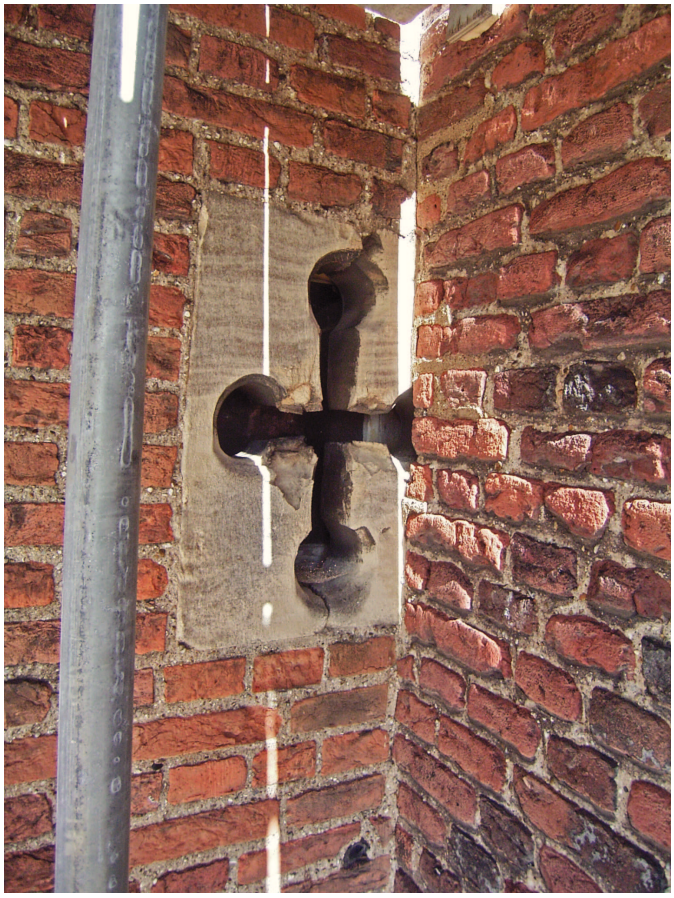

Plate 33: NW turret, arrow loop window adjacent to central face brickwork

Plate 34: North elevation

Plate 35: South elevation, note former pitched roof detail on adjacent range

Plate 36: Ball finial during removal of leadwork

Plate 37: Ball finial during removal of leadwork

Plate 38: Ball finial during removal of leadwork

Plate 39: Ball finial during removal of leadwork

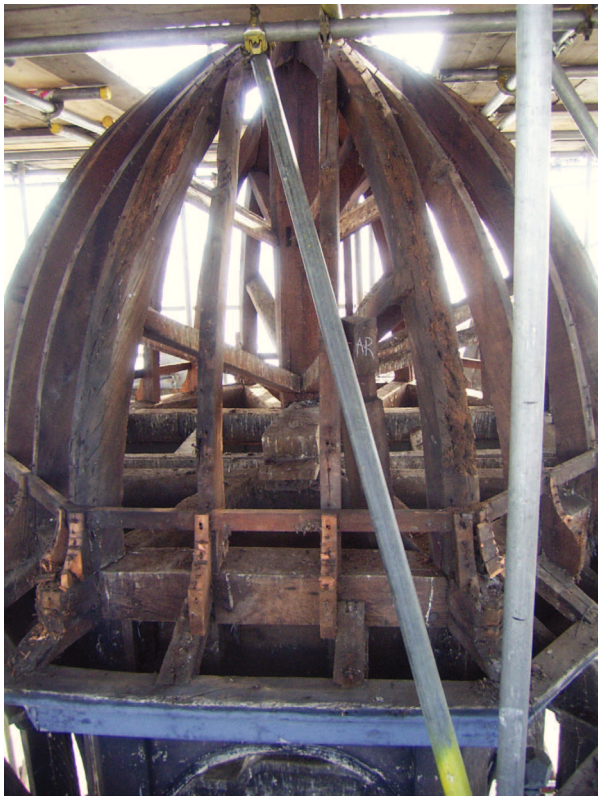

Plate 40: lantern cap frame following removal of lead and sarking boards

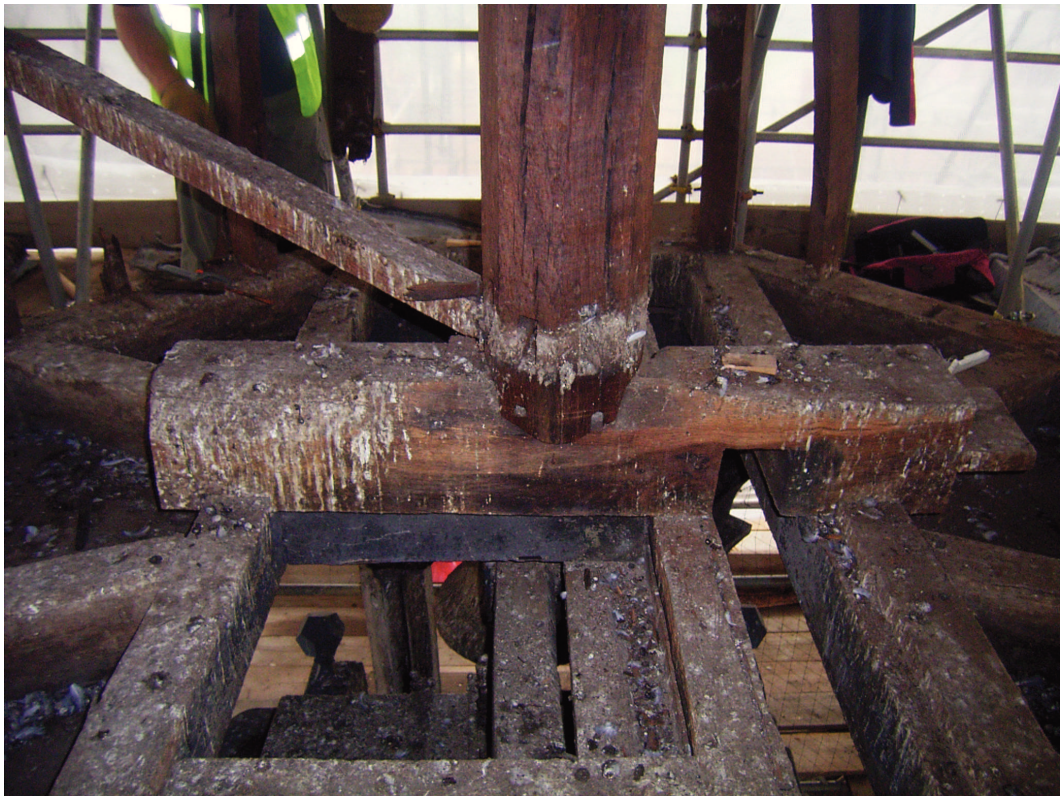

Plate 41: Base of octagonal post within lantern cap frame

Plate 42: Removal of lead from lantern

Plate 43: Bell frame following removal of lead

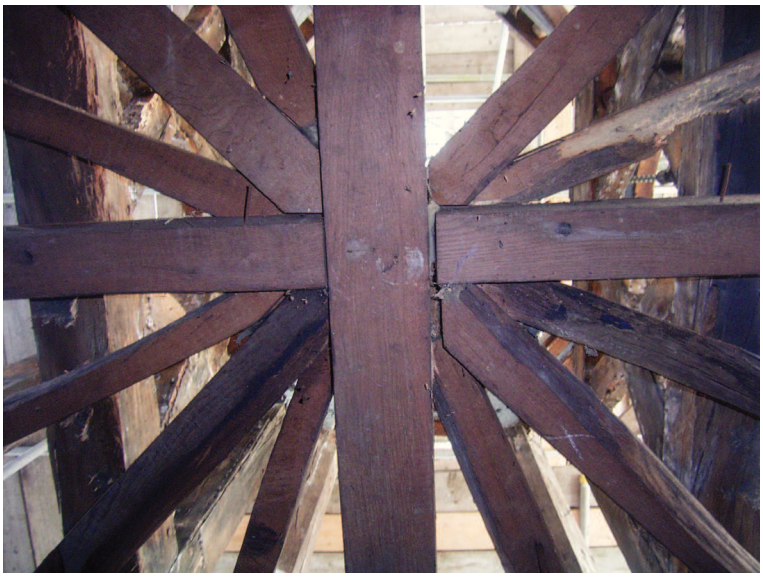

Plate 44: Underside of lantern floor following board removal

Plate 45: Detail of frame within lantern base, forelock bolt fixing for scroll

Plate 46: Lantern base after removal of lead

Plate 47: 18th century and later supports within cupola

Plate 48: SE turret brickwork following removal of lead plaque

Plate 49: NE turret brickwork after removal of lead plaque

Plate 50: SW turret brickwork following removal of lead plaque

Plate 51: NW turret brickwork following removal of lead plaque

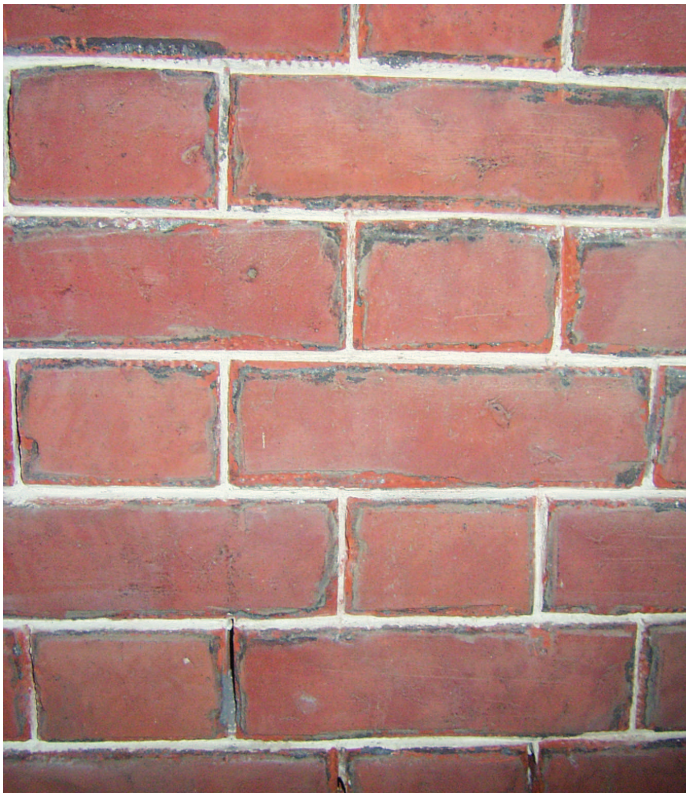

Plate 52: NW turret lower brickwork following raking out of black ash mortar

Plate 53: NE turret terracotta roundel (Augustus)

Plate 54: Pencil graffiti on cupola sarking board

Plate 55: Removal of oriel window upper stonework and frame

Plate 56: Detail of stone frame for slate clock (Base Court)

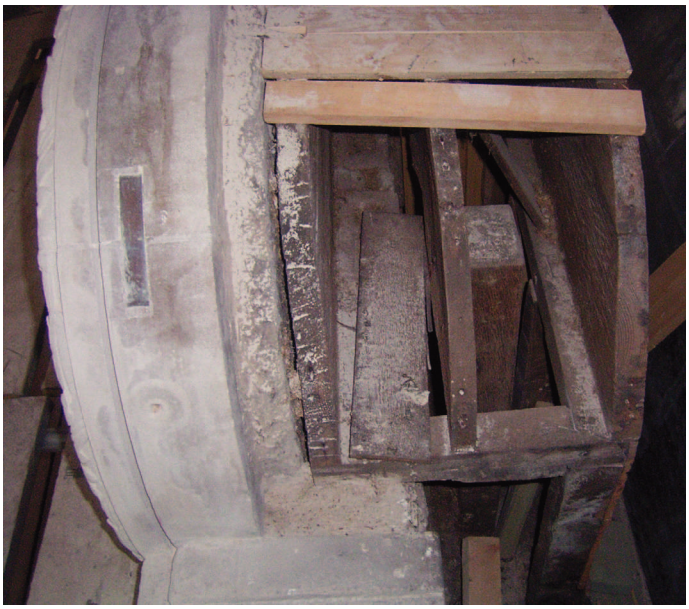

Plate 57: Detail of slate monogram stonework and frame

Plate 58: Reused stonework within NE turret upper string course

Plate 59: Reused stonework within NE turret upper string course

Plate 60: Completed west elevation

Plate 61: Completed east elevation

Historic Building Recording

Anne Boleyn Gatehouse Hampton Court Palace

Appendices

oxford archaeology south

August 2009

Client: Historic Royal Palaces

HISTORIC ROYAL PALACES

Issue No:1
NGR: TQ 157 685

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Misc. Images not within Statement of Significance

Image of the Astronomical Clock dated 1930 showing pre-1960 stonework

http://www.gettyimages.co.uk/detail/50703670/Time-Life-Pictures

News photographs of the reinstatement of the Astronomical Clock, 25 February 1960

http://www.gettyimages.co.uk/detail/78411003/Hulton-Archive

http://www.gettyimages.co.uk/detail/3416836/Hulton-Archive

APPENDIX II HISTORIC PAINT ANALYSIS REPORTS

The Astronomical Clock by C. Hassall (Jan 2008)

The Lantern by C. Hassall (Feb 2008)

The Brickwork, Slate Clock and Lamp by C. Hassall (Feb 2008)

The attached paint analysis reports were commissioned by Historic Royal Palaces and are included within this report for reference purposes.

ANNE BOLEYN GATEHOUSE CONSERVATION

ANALYSIS OF THE PAINT ON THE

ASTRONOMICAL CLOCK

Contents of report

C. Hassall, Paint Analysis
5, Patshull Road, London NW5 2JX

Report no.A112a
January 2008

CLOCK DIALS

Earliest paint found on the fronts of the clock dials

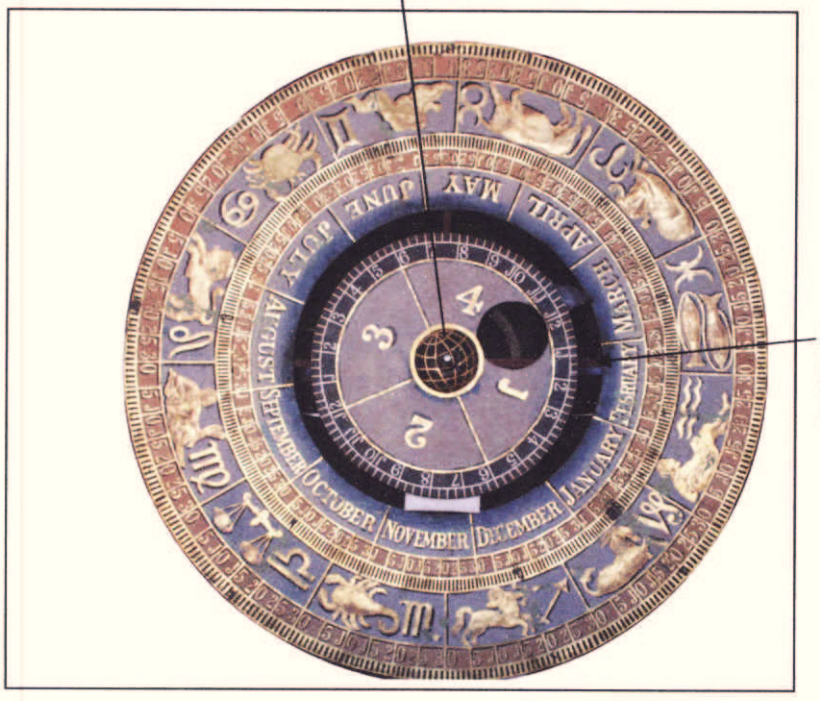
In two samples only, some particles of azurite [natural copper carbonate] were found, resting on the very degraded remains of a lead white ground. The azurite was finely-ground, and seems to have been of good quality.

One sample came from the inner edge of the central pivot hole of the middle disc. The other came from the inner edge of the main disc.

It is impossible to say if the azurite is from the original scheme, but as the pigment ceases to be used around 1700, we can be sure that it is, at least, no later than seventeenth century.

Centre of central disc, under domed, black and gold covering

Azurite found here, under the edge of the copper, on the iron support. [Samples C7b and C16]

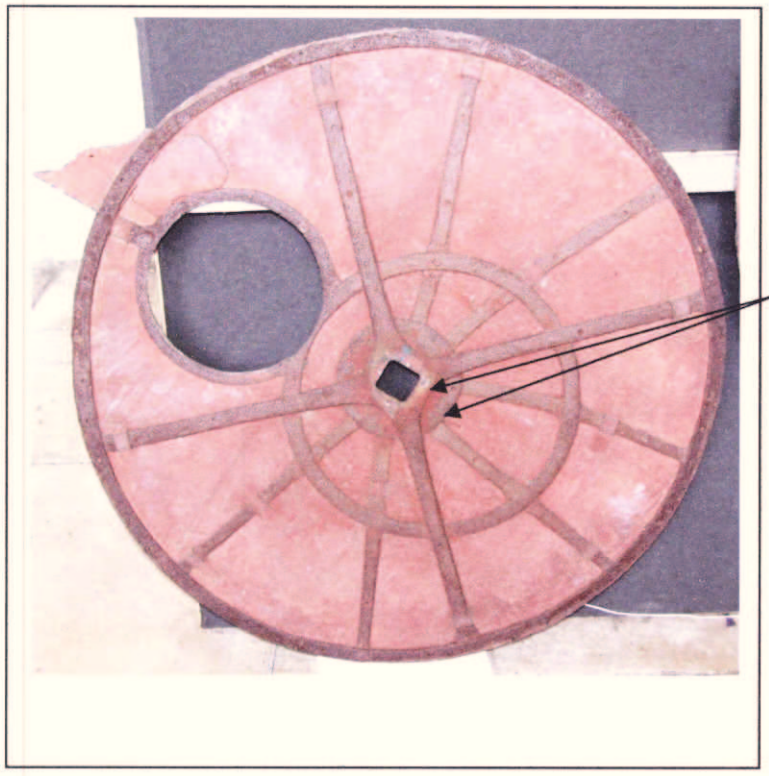


Azurite also found here, on supporting iron cross-bar [Sample C2]

Earliest paint found on the reverse of the dials

The backs were not cleaned down in 1960, but have been attacked by rust over the years. The best examples of paint were found in the angles formed by the iron bars of the supporting skeleton, and the flat of the disc itself.

The earliest paint found was a dark brown iron oxide. At first it was thought that this was a layer of rust, but in dispersion the brown has the appearance of earth pigment, and there is a distinct film of oily dirt on the surface of the layer. It may not be original, but iron oxide pigment was commonly used as a primer for iron before the nineteenth century.



Later paint schemes found on the front of the main dial.

In cross-section C2(ii) from the inner edge of the main dial, we can see that the early azurite is covered by two or three very discoloured and degraded layers. They test positive for lead, and appear to be the remains of paint. They may have once been blue, but they are so discoloured, that it is impossible to tell. The brown colour is due in large part to dirt but also to iron oxide from the support.

In the same cross-section we can see that the discoloured and dirty layers were followed by a pale grey layer of lead white and carbon black. This may have been an undercoat, or it could have been a finish coat as it has dirt on the surface. This grey could be any date.

The grey was followed by two layers of pure carbon black. As Sample C2(ii) came from the inner edge of the clock disc, these black layers could have been from outlines. The blacks were followed by the 1960 layers. In sample C1, however, taken from the outer edge of the disc, a nineteenth or early twentieth century bright blue based on lead white and French ultramarine was found.

Later paint schemes found on the front of the innermost dial

The evidence for the azurite scheme was not as good as in sample C2(ii) from the main dial, but the fragments of samples C7b and C16, taken from the edge of the central pivot hole, provided evidence for a set of four nineteenth and/or early twentieth-century schemes.

These nineteenth-century schemes were all blue, and as the first of them contained the pigment French ultramarine blue which was invented in 1828, they can be dated with certainty. They all contain lead white, and therefore must have been applied to the clock before the 1920s/30s when that pigment was phased out.

The first blue in this set was a pale blue mixed from lead white and French ultramarine. This may have been a paler version of the bright blue found on the outer edge of the main dial [Sample C1], but there the blue had a white undercoat, and here it did not.

The second blue was a grey/blue mixture of French ultramarine, lead white and carbon black. This blue had acquired a layer of thick, oily dirt on its surface by the time it was painted over.

The third blue in the set was a violet mixture of French ultramarine, lead white and a few particles of vermilion. The layer has dirt on the surface and has degraded. It may have been in position longer than other schemes.

The final blue was based on Prussian blue and was painted over a pure lead white undercoat. It was a much darker blue than the ones used earlier, and it may have looked almost black at a distance.

In Sample C7b the final blue is covered by the red/brown iron oxide used to seal the back of the dial. There is an overlap of paint from the front and paint from the back because the sample was taken from the edge of the disc.

Later paint schemes found on the back of the innermost dial

Samples C3 and C4 show that after the initial dark brown, the backs of the dials were painted grey. Remains of three grey paint schemes were found. The first was a pale, silvery grey, the second and third were dark, steel greys. These greys could be any date.

The final grey has extremely thick dirt on the surface and there may have been a long period when the backs of the dials were neglected.

The sequence picks up with a set of three red/brown paint schemes based on red iron oxide. The last of these coincided with the final very dark blue nineteenth or early twentieth-century scheme seen in sample C7b, so all three are likely to be no earlier than nineteenth century.

General comment on the early paints found.

As paint from the front has only survived on the edges, it can only give limited information. The failure to find any early red or early gold is not significant.

The azurite blue, which could be from the original scheme, came from areas which are blue today, so some areas, at least, are following an early colour scheme.

1960 DECORATION

Cleaning of the clock dials in 1960

The front faces of the three main discs were certainly stripped in 1960, as there is nothing at all remaining underneath the present paint scheme.

The edges of the discs were also cleaned, but less thoroughly. The backs of the discs were not touched.

1960 was not the first time that the paint was cleaned off. Samples taken from the edges and the back, in protected areas, contain the remains of earlier schemes, and in the cross-sections one can see that the layers are interrupted as a result of being scraped or sanded more than once.

The fragmentary remains of earlier schemes [mostly nineteenth-century] were found on the outer and inner edges of the main disc, and in two areas of the small disc with the cut-out circular hole for the moon phases: on the back, and around the edges of the central pivot hole.

The 1960 paint scheme

It is clear that the outer surface of the copper discs were thoroughly cleaned of all earlier paint layers, as no trace of any earlier scheme was found despite numerous samples being taken.

The decoration was built up in several layers. First, a thin white primer was applied to the clean metal surface, then a green ground layer was brushed over the top in all the areas that were going to be painted rather than gilded.

Two layers of blue were applied in blue areas, and two layers of red in red areas, with dark blue and dark red applied over paler undercoats. Organic analysis has established that the type of paint used was an alkyd resin

The gilding was applied over the red and blue, using an oil gilding technique, and pure black outlines were painted around the gold shapes.

The final process was the painting of the brown glaze details on the gold.

No trace of varnish was found. If a varnish was applied in 1960, it has now all flaked off.

<u>White primer.</u>

The main pigment in this layer was titanium dioxide white. The titanium white was identified by polarised light microscopy and from its fluorescence in UV.

<u>Green undercoat</u>

A sample of this was analysed using a scanning electron microscope [SEM]. It was found to contain titanium white and a small amount of zinc white, as well as a range of common extenders, including large amounts of calcium carbonate, and smaller amounts of magnesium carbonate, barium sulphate, white clay and silicates.

The use of so many additives, and the fact that there was more calcium carbonate than there was titanium white, suggests that the green was from a relatively cheap range of paints, and not artist's quality material.

The tinting pigments in the green were chrome yellow and an unidentified organic blue. The SEM identified iron in the paint, but no iron oxide pigments were found and the iron must have been present in the form of iron oxide salts from the clock support

Blue paint

A sample of the un-degraded blue was analysed using the SEM. Like the green undercoat, this paint was also found to be based on titanium white. It contained extenders, but not the same amount as found in the ground layer. The additives were barium sulphate, white clay and silicates.

The tinting pigment in the blue was an unidentified organic one. It may have been Prussian blue, but in dispersion the blue particles did not have typical Prussian blue characteristics, and it is more likely that it is a twentieth-century blue.

As in the green undercoat, the SEM identified the presence of iron. No iron oxide pigments were used, and it must have migrated from the metal dial.

Red paint

The red was not analysed by SEM, but in dispersion, and under the polarising light microscope, the same white pigments found in the blue were seen to be in the red also. The tinting pigment was an unidentified synthetic organic red.

Black paint

The black which was used for the outlines, and for the background to outer edge digits, was pure carbon black.

Gilding

Gold leaf was laid over an oil size containing a bright yellow synthetic iron oxide.

Glazing over gold

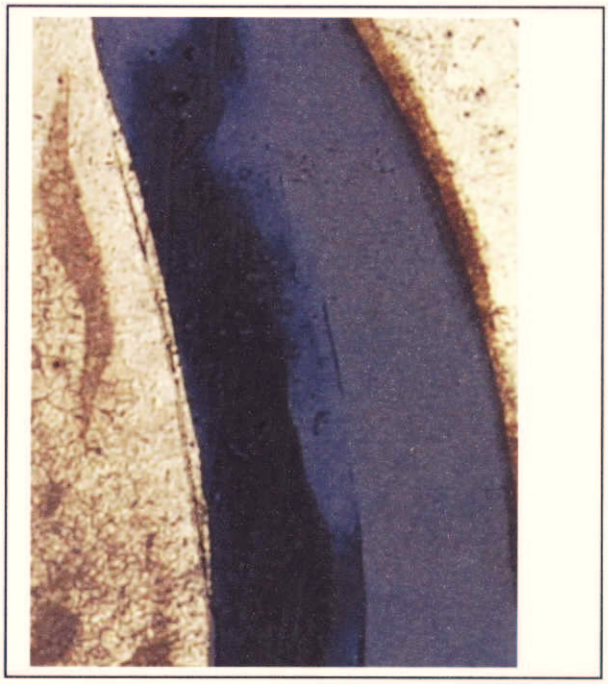
The pigment in the brown glaze was largely organic, and therefore not identified, but a small amount of red iron oxide was included.

No obvious difference could be seen between the brown glaze used for the fine detail and the brown glaze used for the broader brush strokes.

Deterioration of the 1960 paint

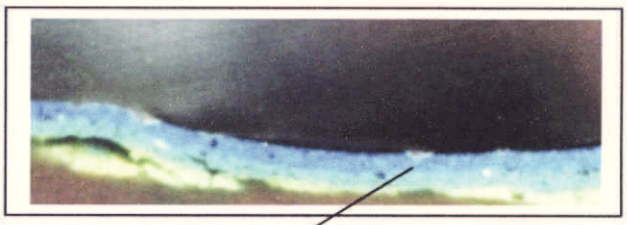
The pink film which coats all the paint on the clock face, but affects the blue most strongly, is not the remains of a varnish but the degraded and faded upper surface of the final paint layers. Both the blue and the red are based on organic pigments which could well have faded, but it is surprising that both colours should have turned the same pink.

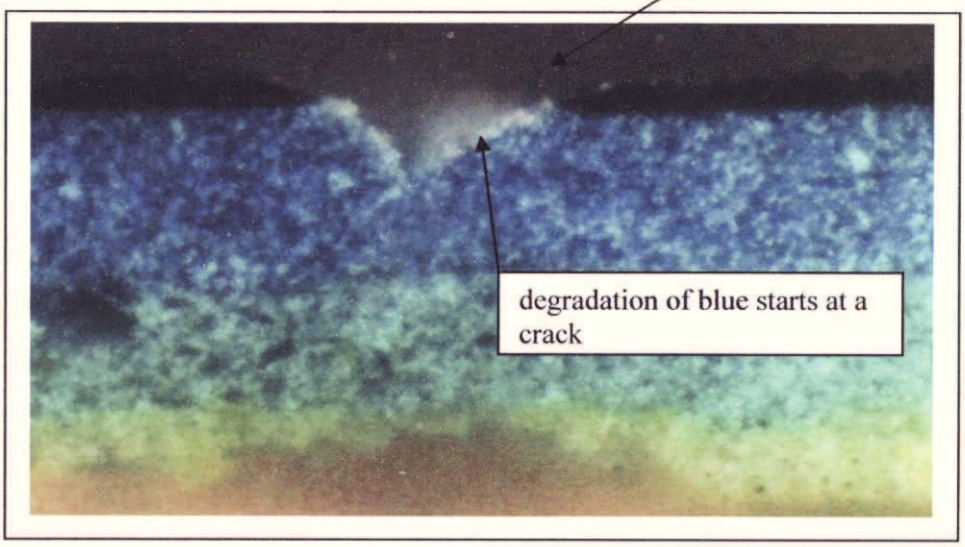
In the areas where black shadows and outlines appear to have been 'eaten' away and replaced by the pink, the cross-sections seem to provide the answer. They show that the degradation starts at a fine crack in the black. The crack allows the underlying blue to be exposed to air and light. The surface of the blue is degraded and turns pink. Gradually the blue surface becomes etched, taking the black with it.



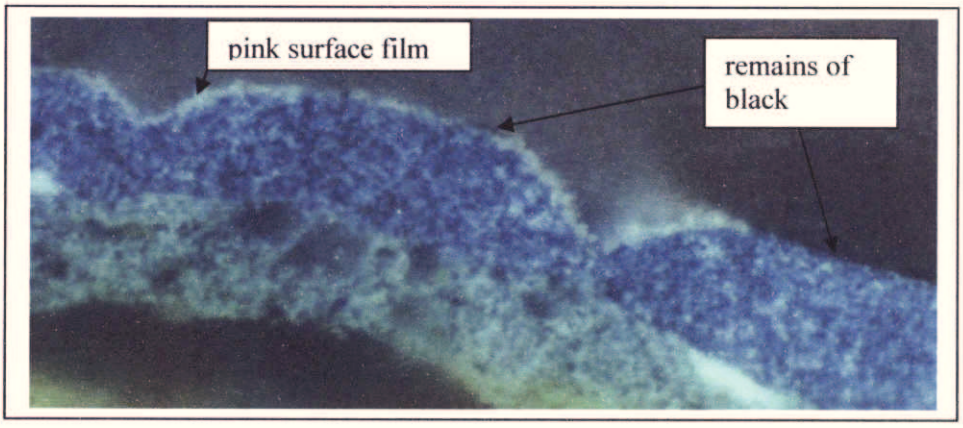
The etching of the black paint starts where the black layer is thinnest, leaving islands of thicker paint still intact.

Cross-section through etched black





In this cross section, taken from an area which was once black, we can see that the degradation of the blue started in two cracks but then spread, so that there is now a pink film across the whole surface.



Experiments with solvents found that the pink layer was easy to remove with a swab of water. This is presumably because the medium has broken down.

The chemistry behind this degradation is not known, but the fact that iron oxide was detected in the blue layers, despite no iron oxide pigments being used, suggests that iron oxide salts are migrating through the paint, and this may have contributed to the damage. It certainly might explain the pinkish colour of the degraded surface.

The reason for the behaviour can only be guessed at, but it is clear that the paints used in 1960 are not reliable.

1960 gilding

The gold leaf does largely protect the underlying paint, in fact, the only area where the original colour of the red can be seen is under gilding. However, even under the gold the degradation has started to form along crack lines.

OUTER CLOCK RING PAINTED ON STONE

The original scheme, and seven later schemes, were found, but there may have been more. There is evidence that there was some sanding down at one point in the nineteenth century, and layers may have been lost.

The appearance of the original scheme was only partly discovered. Despite taking numerous samples, on two separate occasions, the original treatment of the background to the gilded numerals remains conjectural, and no evidence has yet been found for original fleurs de lys.

Original scheme

This was only found in samples R1, R4, R7 and R11.

Ground layer

The ring was first painted with a ground of stone-coloured oil paint, mixed from lead white, a little carbon black, and a mixture of yellow and yellow/brown iron oxides. This paint was brushed directly onto the stone without any separate priming coat. We can tell that it is the original scheme because in the samples which include a piece of stone, there is no dirt between stone and paint.

Gilding

The gilding for the numerals was laid over the stone-coloured ground using an oil gilding technique. The dull yellow oil size was mixed with a lot of ochre and a small amount of lead white. The addition of lead white to the yellow oil size is what one would expect to find in early oil gilding.

The original gilding was only found in Sample R4, from the numeral X, although several samples were taken from numerals VIII, IX and XI and from two of the fleurs de lys. It is clear that a lot of the original scheme has been lost.

This investigation has been able to prove that the original numerals were gilded, but has not found evidence of original gilded fleurs de lys. Probably only by removing later layers in a relatively large area, will it be possible to determine whether there were any fleurs de lys originally.

Background colour

In two samples taken from background areas [samples R11 and R17] the cross-sections show a layer of solid carbon black over the original stone-coloured ground.

This may mean that the background was originally black, but if so, the way it was applied is unusual. The original gold leaf was not laid over black, but over the stone-coloured ground, so if the background was intended to be black, the painters would have had to paint the black carefully around the gold letters, which is not the normal method.

On the present evidence it is not possible to say if the background was black or stone-coloured. What one would probably have to do to resolve this is to try to reveal the edge of an original gilded numeral. What is clear is that the background was certainly black by the second scheme, and remained a dark colour thereafter.

Later schemes

A scheme with black background and gold letters replaced the original.

The next decoration involved a dark brown background colour with gold numerals

The fourth scheme was an elaborate decoration which had a lead white ground, a dark grey undercoat and black top coat, then oil gilding over a yellow ochre oil size.

The fifth scheme was preceded by a coat of pure red lead oil paint which was brushed over the whole ring, presumably as a sealing or priming coat. In many of the samples this red layer is resting on stone, and the decorators may have brushed down the surface to dislodge loose paint flakes before applying the primer. The decoration itself consisted of a dark grey undercoat, black background top coat, then oil gilding over a yellow oil size.

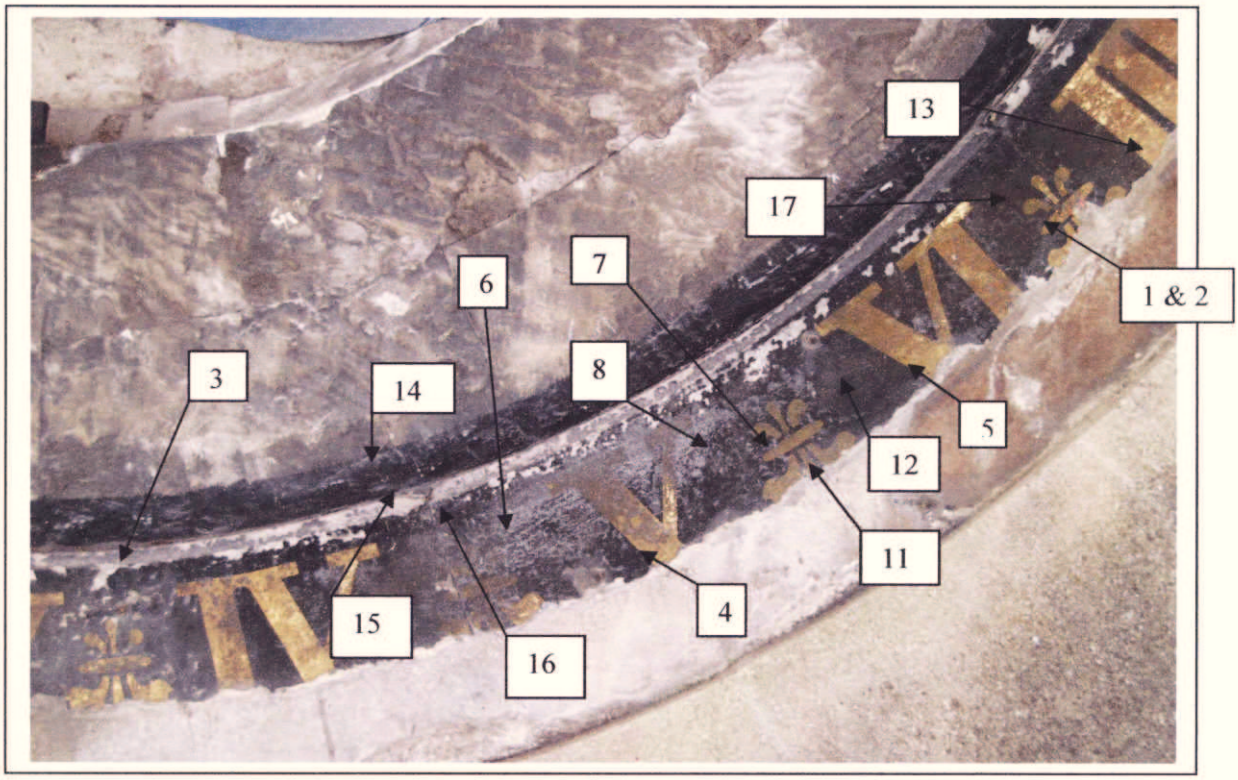
The oil size of the fifth scheme was a bright yellow colour, containing yellow iron oxide, only. The absence of any lead white suggests that this scheme was applied in the mid or later nineteenth century

The evidence for the sixth scheme is patchy. The gilders used a clear oil size and it could be a late nineteenth century scheme.

The seventh scheme was still based on lead white and so cannot be any later than the early twentieth century. A grey undercoat and a black top coat were found, but the gilding layers were not picked up.

The final scheme was based on zinc white and must therefore have been painted up in the early or middle years of the twentieth century.

Sample locations



EXAMINATION PROCEDURE

Samples were taken as listed below.

Samples were taken on three separate occasions. In some areas more than one fragment was taken from each sample location

The contents of the sample packets were examined under a binocular microscope at magnification x10, then the best examples were selected for cross-section analysis

The samples were mounted in Tiranti's cold setting, clear casting polyester resin. They were cut and polished by hand.

The cross-sections were viewed in halogen light at magnifications up to x500 using a Zeiss Axioscop binocular microscope, and at magnifications up to x400 using a Zeiss UV fluorescence microscope. The fluorescence microscope was used to check for evidence of any varnish layers.

Paint from the coloured layer was extracted from the cross-sections under the low powered microscope. Paint dispersions were made on glass slides using Meltmount resin, and the pigments identified using a Zeiss Axioscop Polarising Light Microscope, at magnifications up to x1000.

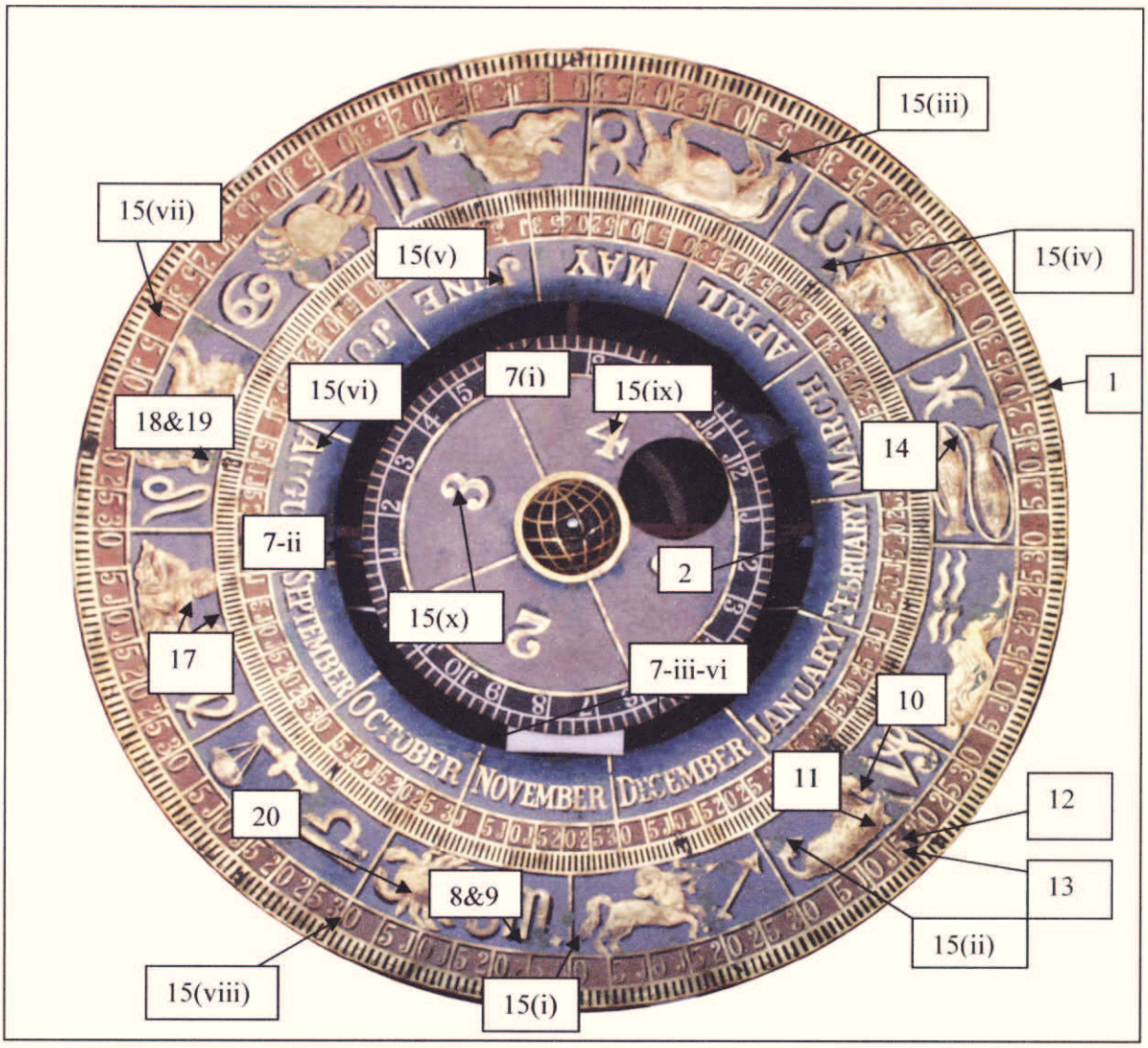
A chemical test for lead, using dilute nitric acid and potassium iodide, was carried out on paint from all the layers containing white pigment.

Material from the 1960 layers was subjected to elemental analysis using a scanning electron microscope [SEM]. The layers analysed were the green undercoat, an example of undegraded blue and an example of the pink surface of degraded blue.

SAMPLE LIST

Main dial

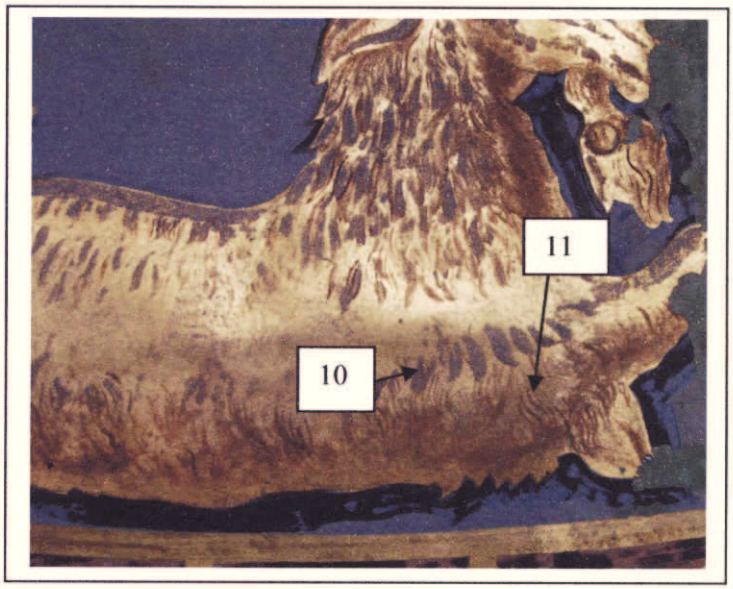
C1i-iv Outer edge. Various locations, at overlap of copper plates.
C2 Inner edge, next to 'February', paint splashed onto iron cross-bar.
C7i-vi Inner edge, various locations
C8 Scorpio – sample of intact blue
C9 Scorpio – sample of blue with pink surface
C10 Capricorn – fine glazing detail on gold
C11 Capricorn – broader brush strokes on gold
C12 Capricorn – faded red area below goat
C13 Capricorn – unfaded red under gilding
C14 Pisces - etched black outline with pink



Brown glazes on gold

10 fine lines

11 broader lines, now opaque



C15 Ten locations across the face of the main dial, to see if any earlier paint survives under the 1960s decoration.

(i) Tail of Sagittarius

(ii) Tail of Capricorn

(iii) Back hoof of bull

(iv) Tip of horn of ram

(v) 'J' of June

(vi) 'A' of August

(vii) Inside '0' of 30 near Leo – outer red border

(viii) Inside '0' of 30 near Libra – outer red border

(ix) '4' of innermost blue circle – gold on blue

(x) '3' of innermost blue circle – gold on blue

C17 More examples of etched black outlines, from reclining man

C18 Example of white 1960s primer from damage near Leo

C19 Example of 1960s green undercoat from damage near Leo

C20 Example of brown glaze used over gold, taken from Scorpio.

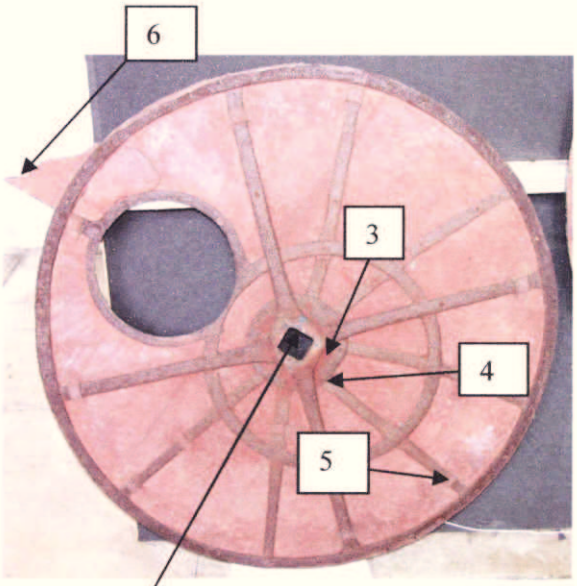
Back of inner disc with cut out circle

C3 In angle of large iron support bar and underlying iron disc - on iron

C4 In angle of smaller support bar and copper disc – on iron

C5 Paint on small lead strap

C6 Edge of 'pointer' at outer edge



<u>Front</u> of inner disc with cut-out circle – central hole
[see p.1]

C7b and C16 - Central, pivoting hole, underneath domed cover with black and gold decoration. Sample taken from the front, between copper disc and iron support bars. Paint resting on iron.

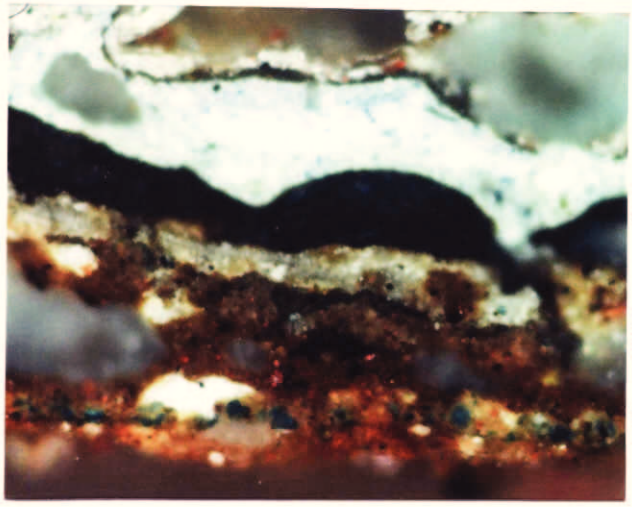
Painted stone outer ring [see page 9]

R1 Fleur de lys, between VIII and IX, rh side, upper layers
R2 Lower layers and stone, below R1
R3 1960s mortar over red lead, at edge, lower left side, at chamfered edge
R4 Numeral X
R5 Numeral IX
R6 Background between X and XI
R7 Fleur de lys
R8 Background next to fleur de lys
R11 Fleur de lys between IX and X
R12 Background between fleur de lys and IX
R13 Numeral VIII
R14 Upper edge of black background
R15 Black background on moulding above numerals
R16 Black below moulding, but above numerals

SAMPLE C2ii
Iron cross bars of main dial, next to 'February'

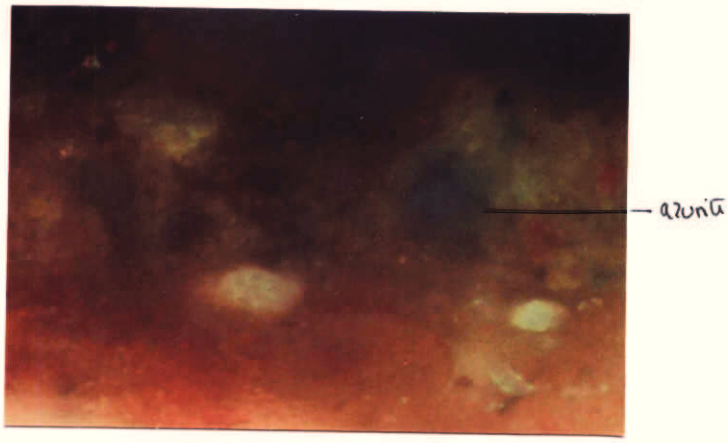
At the top – 1960s black over white primer. At the bottom a line of azurite particles over a thin layer of lead white.

[x200]



Detail of an azurite particle in degraded lead white.

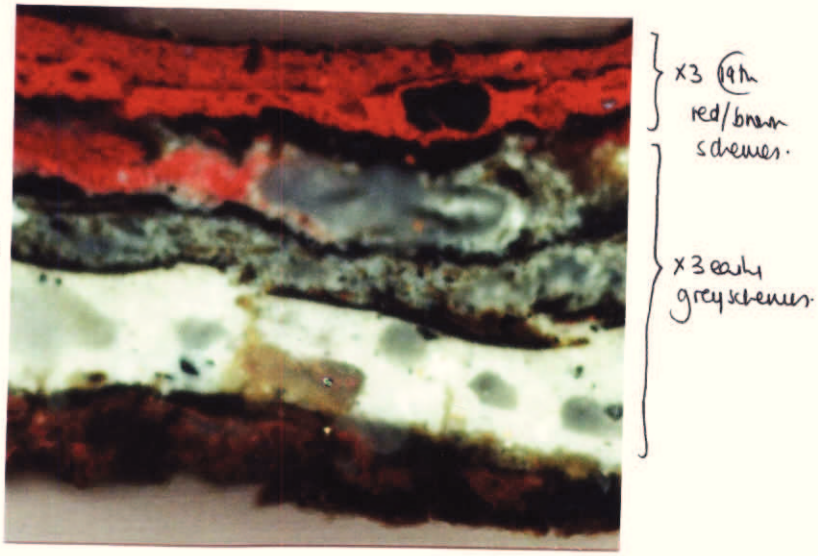
[x500]



SAMPLE C4i
Reverse of inner dial - paint between iron skeleton and copper sheet.

Showing the paints used for the reverse: first dark brown iron oxide, then greys, and more recently red/brown iron oxide.

[x200]



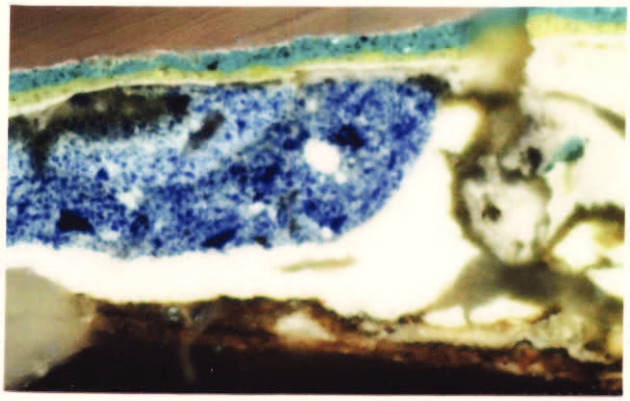
SAMPLE C4iii
Same area, but with some of the rusted iron substrate.

[x200]

SAMPLE C1
Outer edge of main dial, between Capricorn & Pisces

A C19th blue based on French ultramarine, over degraded lead white layers.

[x200]



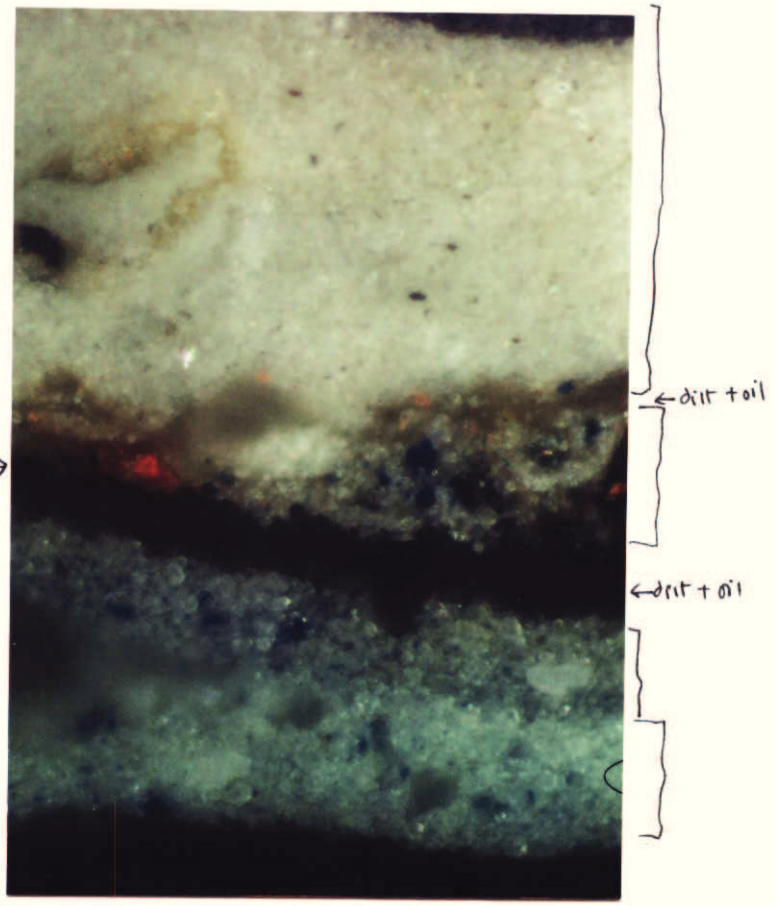
SAMPLE C7
Inner dial with cut-out for moon. Centre of outer face, between iron support bars and copper disc

Red/brown layers used for the back overlap blue layers used for the front.

[x200]

Detail of the four earliest schemes found – all C19th, as they all contain French ultramarine blue.

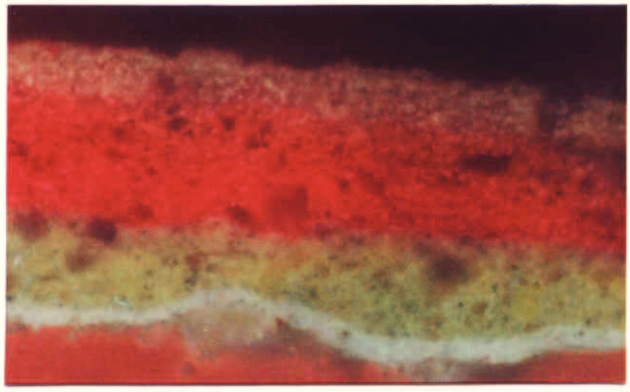
[x500]



SAMPLE C12
Main dial – faded red.
Below Capricorn

White primer, green undercoat, red undercoat and degraded red top coat.

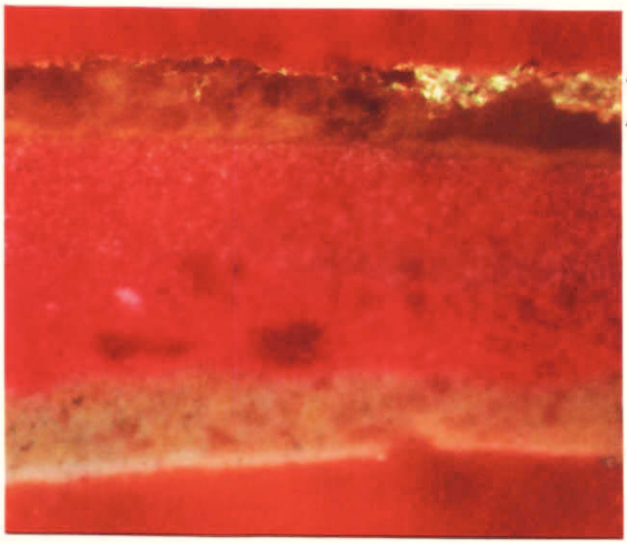
[x500]



SAMPLE C13
Red under gold – not faded.
Gold of Capricorn

White primer, green undercoat, then two layers of red.

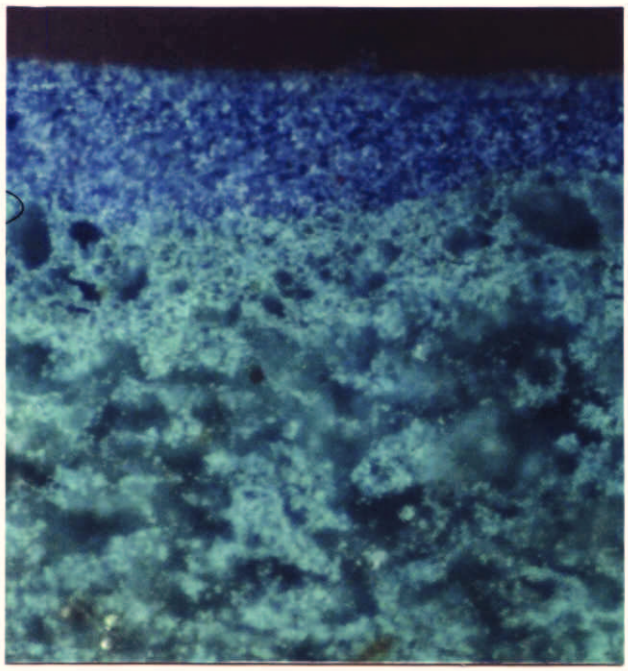
[x500]



SAMPLE C8
Blue – not faded.
Above Scorpio, between October & November.

Primer and green undercoat missing in this fragment

[x500]



SAMPLE R4(i)
Numeral X

At the bottom of the section we can see a fragment of the original gilding over stone colour followed by gilding over dark brown.

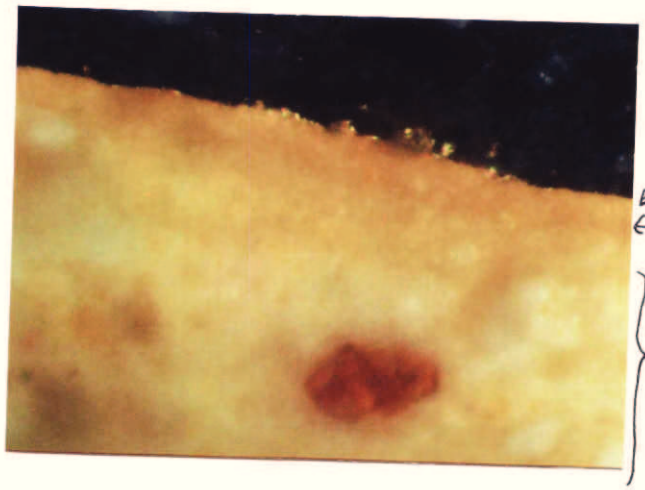
Clearly this area was gilded from the start.

[x200]

SAMPLE R4(iii)
Numeral X

The brown layer is absent in this piece, but there is a large fragment of the original gold

[x200]



Detail of the gilding, with gold on almost pure ochre oil size, over a stone-coloured ground of lead white tinted with yellow iron oxides. [x500]

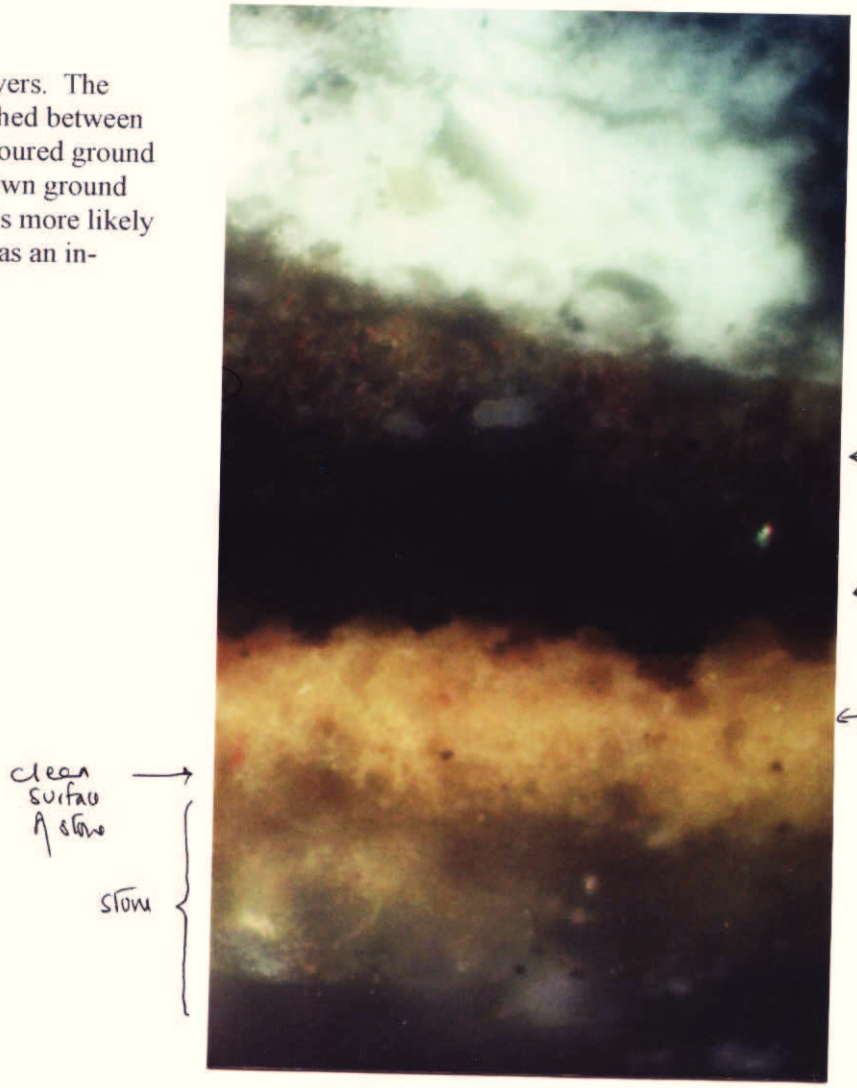
SAMPLE R12
Background between fleur de lys & numeral IX

No recent layers, but at the bottom of the section is the original stone coloured ground with black on top.

[x200]

Detail of the early layers. The black that is sandwiched between the original stone coloured ground and the later dark brown ground may be original, but is more likely to have been applied as an in-between stage.

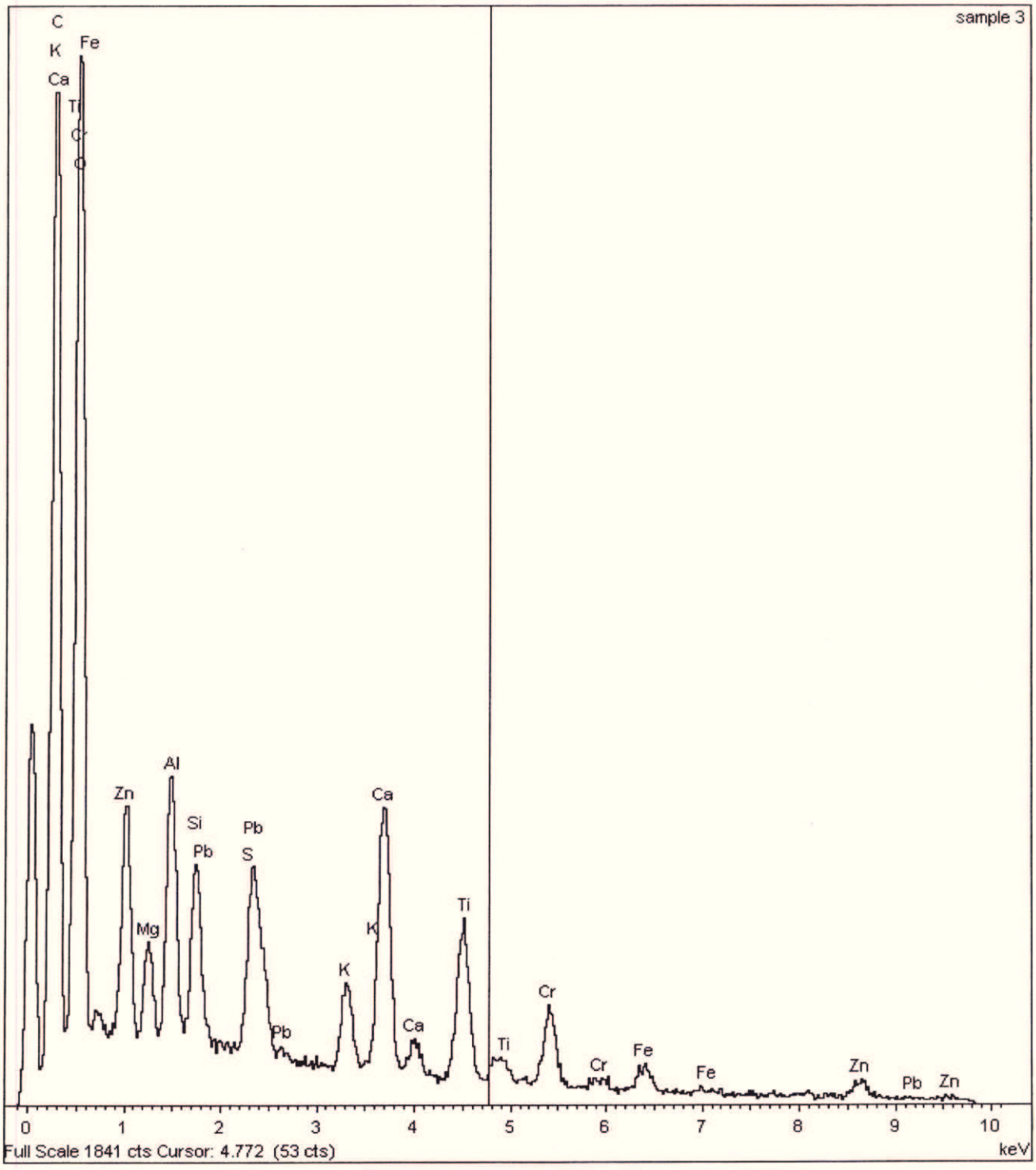
[x500]



SEM ANALYSIS of the green undercoat

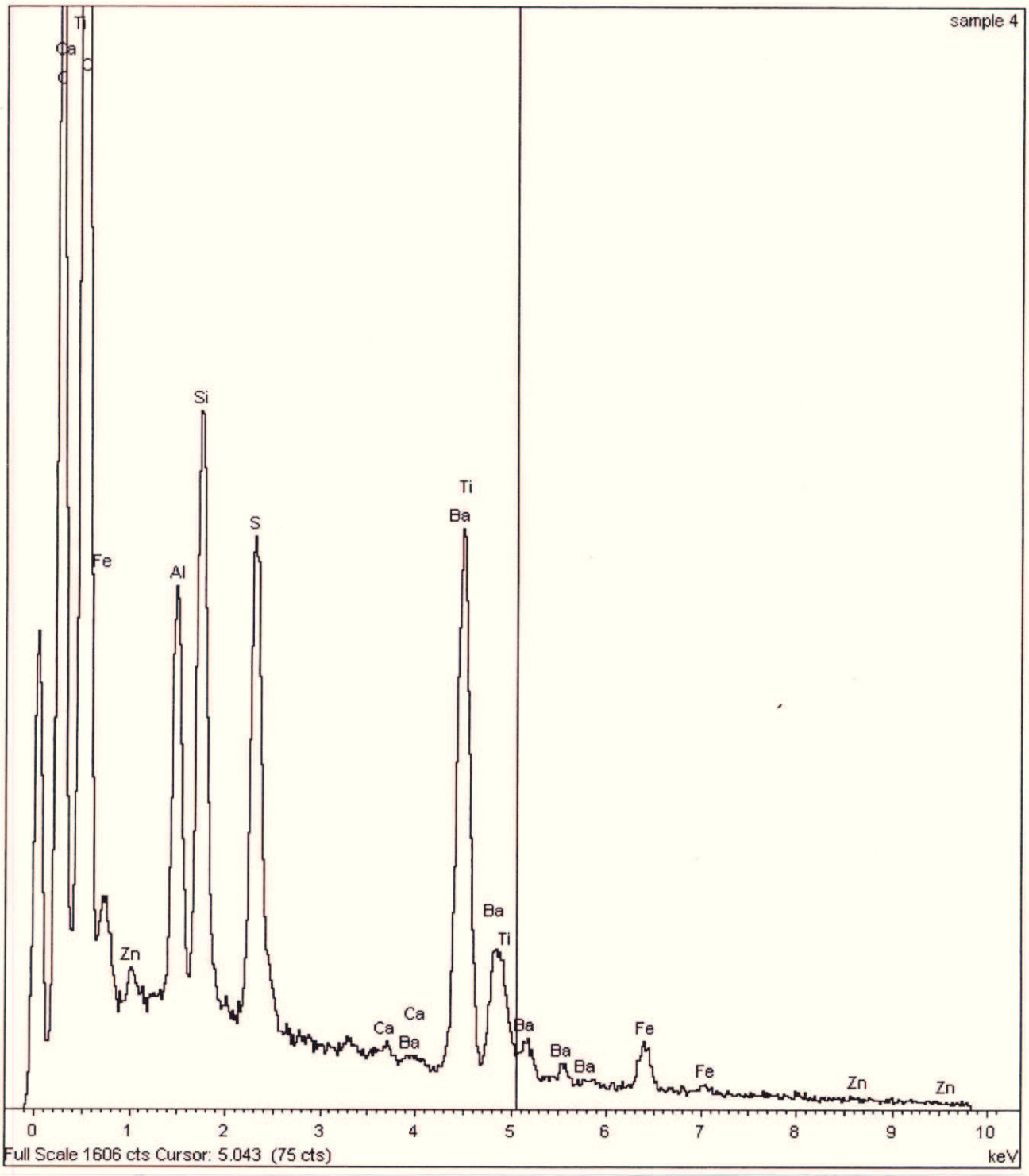
The significant features in the spectrum are titanium [Ti] from titanium dioxide white and zinc [Zn] from zinc oxide white, which are the main white pigments.

The calcium [Ca] magnesium [Mg], barium [Ba] and sulphur [S] are from calcium carbonate, magnesium carbonate and barium sulphate which are common extenders in the cheaper ranges of paints. The aluminium [Al] and silicon [Si] are probably from white clay which is an alumina silicate. The chromium [Cr] and lead [Pb] are from chrome yellow (lead chromate) used with blue to make the green colour. The blue is an organic blue and consists therefore mostly of carbon and oxygen. The iron [Fe] may be from rust. The reason for the potassium [K] is not known.



SEM ANALYSIS of un-degraded blue

Comparing this spectrum with the one for the degraded layer, we can see that it is almost identical. The only difference is that there is a little more of the iron [Fe] in the degraded pink sample, compared to this un-degraded blue sample. Iron salts from the clock disc may be a factor in the chemical change. They may also be responsible for the pinkish colour.

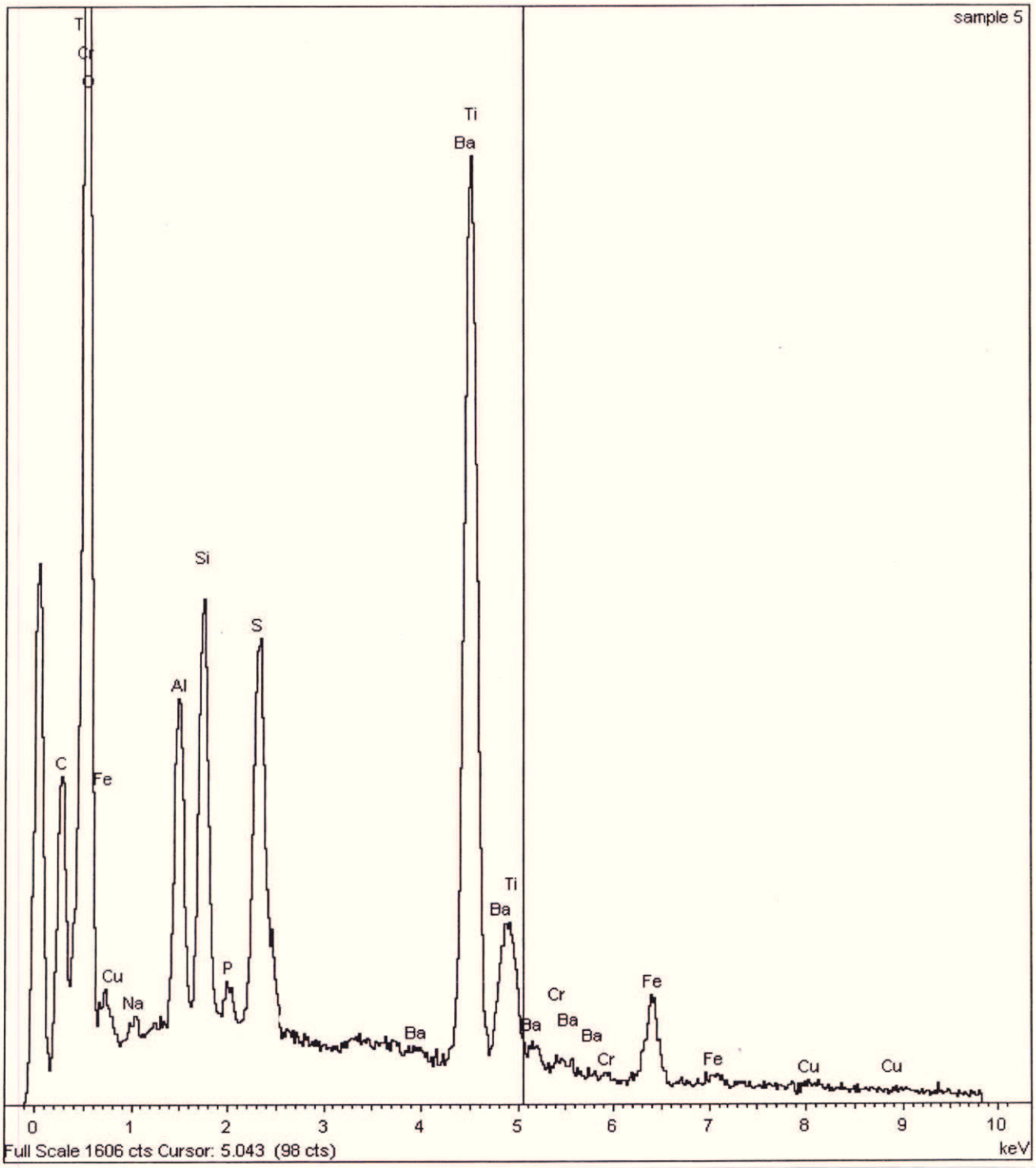


SEM ANALYSIS of the pink surface on the blue

The major feature in the spectrum is for titanium [Ti] from titanium dioxide white.

The barium [Ba] and sulphur [S] are from barium sulphate, and the aluminium [Al] and silicon [Si] are probably from white clay. These are extenders used in many paints.

There is a significant amount of iron Fe], despite the fact that no iron oxide pigments were present in the paint.



ANNE BOLEYN GATEHOUSE CONSERVATION

ANALYSIS OF THE PAINT ON THE

LANTERN

Contents of report

C. Hassall, Paint Analysis
5, Patshull Road, London NW5 2JX

Report no.A112c
February 2008

Background

The lantern was designed by Sir Christopher Wren in 1707. It is currently undergoing a major restoration.

Most samples were taken when the lantern was still in position, but after the lead had been largely removed. Some loose pieces of lead and joinery were examined at a later date.

The main difficulty was the fact that although original paint had survived on protected parts of the interior lead, old paint layers had flaked off the exterior cladding, including the lead on all sides of the columns. The treatment of the exterior lead had therefore to be inferred from the treatment of the interior lead and from the treatment of the exterior woodwork.

Examination procedure

The fragments were examined under low magnification, then mounted in cold-setting resin, to be cut and polished as cross-sections.

The sections were viewed in halogen and in UV fluorescent light, at magnifications up to x500, to compare the layers.

Lead-based paint layers were identified by chemical test [lead nitrate/lead iodide].

The zinc and titanium-based layers were identified from their fluorescence in UV light.

Paint from the earliest layers was dispersed on glass slides and the pigments identified using a polarising light microscope at magnification x1000

LANTERN

The lantern has been painted eighteen times, which is approximately every sixteen or seventeen years.

Original paint found on the wooden elements

Paint which is clearly original was found on all parts of the timber structure which were not clad in lead in 1707. This included the cornice, the capitals, the upper part of the interior, and the finials on the bell frame.

The capitals were stripped at some point in the twentieth century, and then clad in lead, but sufficient paint has survived on them to show that they were originally plain painted wood.

Original paint found on the lead cladding

On the lead itself very little paint has survived, and none on the exterior. Evidence of early interior paint was found in two locations:

(i) Paint dating back to 1707 was found on the lead used to clad the bell frame.

(ii) Paint missing just the first two schemes was found on a piece of skirting protected by the late nineteenth-century stool positioned in the central opening of the north side. The loss of the earliest layers on this piece is likely to have been the result of repairs or adjustments to the lead carried out at some later date.

While no original paint was found on the exterior lead , the fact that the interior lead was being painted makes it likely that all lead surfaces, up to and including the tops of the arches, were in fact treated the same way.

In the 1780 watercolour by John Spyers, it is clear that at this date the lead on the lower part of the lantern was certainly being painted, but the dome was not. It seems likely that the lead on the dome never had been painted.

1707 DECORATION

The wood and the lead were first primed with a thin coat of pure red iron oxide, this was followed by a dark grey undercoat of lead white mixed with fine-ground carbon black. These two coatings were applied both inside and outside the lantern.

The outside was then painted with a stone-coloured oil paint mixed from lead white, some finely-ground charcoal black and some yellow iron oxides.

The stone-coloured paint was used on the cornice, on all five sides of the capitals, and on all five sides of the posts and their skirtings. Evidence for this comes from the single skirting sample [Sample L.13] and from samples taken from all sides of the column capitals [Samples L.20-L.29]. It is assumed that the lead columns will have been painted the same as the wooden capitals

The inside, on the other hand, was painted black.

The main pigment in the paint was charcoal black, but the mixture also contained a little lead white and iron oxide brown to catalyse the drying process. The paint will still have appeared black despite the addition of the white and brown, but it will not have had the intensity of pure black.

The black paint was used on the bell frames, including the facetted wooden finials, and on the interior walls above the column capitals. The soffit was not examined, but it is likely that this was also painted black.

The finials were stripped in the later twentieth century, on the penultimate occasion that the lantern was painted, but traces of original black paint were found in the mouldings of the finial bases.

LATER DECORATIONS

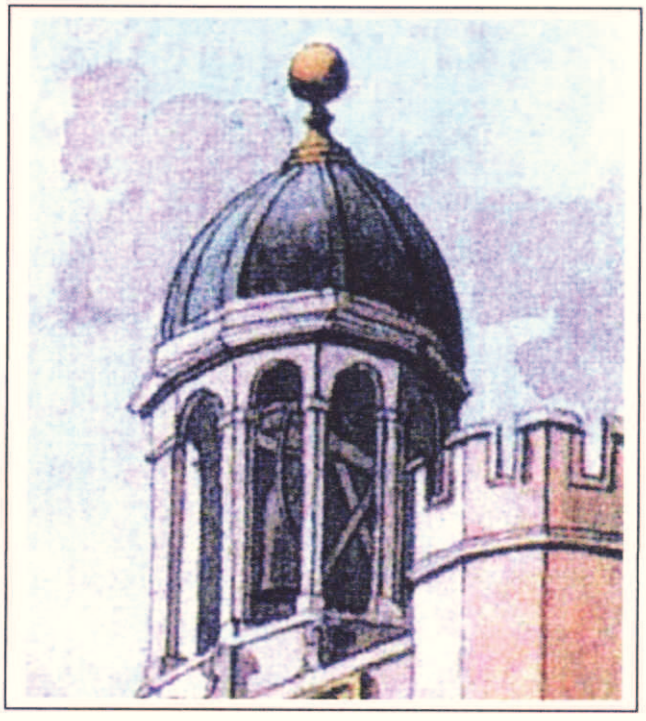
Up to circa 1800?

The next four times that the lantern was painted, a similar treatment was applied. The only difference was that the exterior paint was a bit paler than the original, i.e. more an off-white than a stone colour. The interior continued to be painted black.

These layers cannot be dated, as the pigments are ones which have always been available, however the fact that lead white was still being added to the black, to assist the drying of the oil paint, suggests they were applied before 1800.

The John Spyers watercolour of circa 1780 is the earliest depiction of the lantern.

It is impossible to tell from this detail if the interior is painted dark, or if the dark tone is from natural shadow.



Nineteenth-century schemes

If the lantern was being painted every sixteen years, the two-tone scheme must have been abandoned towards the end of the eighteenth century. By 1800 it was being painted inside and out with a series of off-white and stone-coloured paints based on lead white tinted with iron oxides.

Seven of these schemes were found on the outside, but only six on the inside, so there was one occasion when the interior was missed out.

The watercolours of 1819 and 1826, and the photographs dating from the second half of the nineteenth century, all show a pale coloured paint used on the outside. In those images, the inside of the lantern is naturally dark from shadow.

Twentieth-century schemes

The final pure lead-based paint scheme was a plain white. It was followed by two white schemes based on a combination of lead white undercoat and zinc oxide top coat. This type of paint was briefly employed at the end of the nineteenth century, but was widely used in the early decades of the twentieth century.

The 1922/24 photograph must show one of these pure white schemes.

After the first of the pure white schemes, the capitals were stripped and clad in lead for the first time. The rest of the woodwork was more lightly sanded.

Zinc oxide weathers badly, and in fact the final two white schemes are in poor condition, with the paint altered to a greyish colour. There may have been more of these layers which were lost when the lantern was sanded down prior to the penultimate decoration.

The final two paint schemes date to the second half of the twentieth century, as they are based on the pigment titanium dioxide white. Both schemes were a blue/grey. The colour may have been intended to match the colour of the lead on the dome, or it may have been an attempt to reproduce the 1709 grey undercoat which does look like an original paint scheme when the later layers are scraped off.

GILDED FINIAL

Nine layers of gilding were found, including the original gold, i.e it was gilded approximately every thirty years.

1707 GILDING

A ground of stone coloured paint mixed from lead white, yellow ochre, and a bit of carbon black, was applied to the lead cladding the finial, then gold leaf was laid over a dull yellow oil size containing yellow ochre as well as lead white.

The stone coloured ground is darker than the stone coloured paint used to decorate the lantern itself, and no red primer or grey undercoat was used. It seems that the gilding of the finial was a separate procedure from the painting of the lantern.

The ball itself was not examined, only the collar.

Collar of finial

The ball itself was not examined, only the collar.

Samples were taken from the concave moulding above the collar, from the collar itself, and from the convex moulding at the bottom. They all showed the original gold.

Samples were also taken from a lead 'apron' which was inserted between the base of the finial and the covering of the dome. This 'apron' had twentieth-century gold on it but no earlier gilding schemes.

LATER GILDING SCHEMES

The first four re-gildings could be eighteenth-century or early nineteenth, as the oil size that was used was mixed with lead white as well as ochre. The addition of lead white becomes uncommon after the mid nineteenth-century.

The fifth re-gilding employed a clear oil size and cannot be earlier than the later nineteenth century.

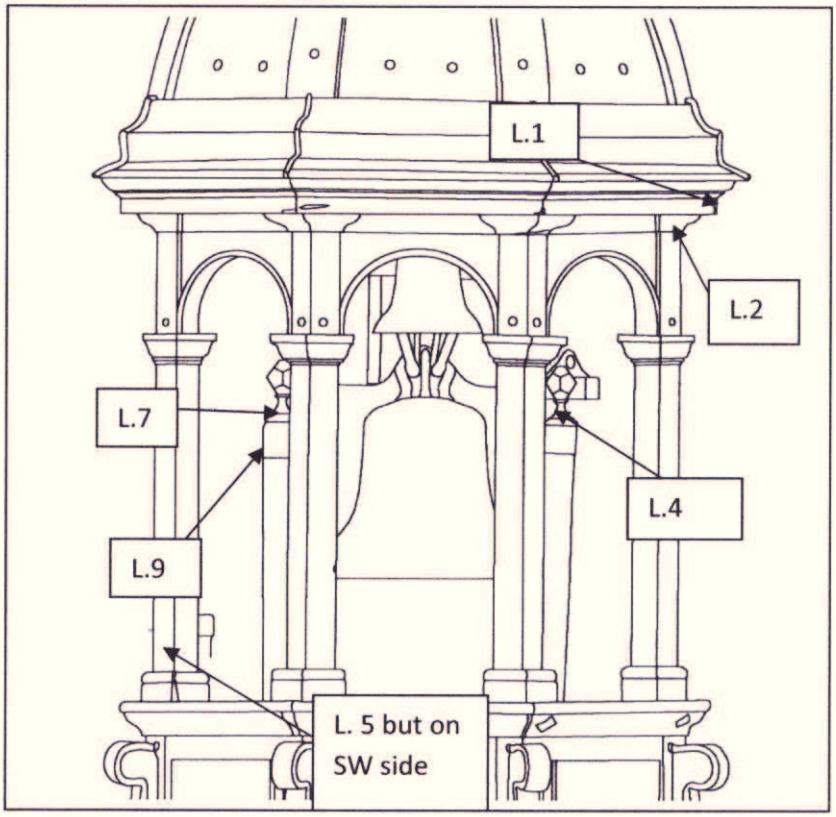
The sixth and seventh re-gildings could be early twentieth-century.

The most recent gilding was a later twentieth-century scheme, over an undercoat containing titanium dioxide white.

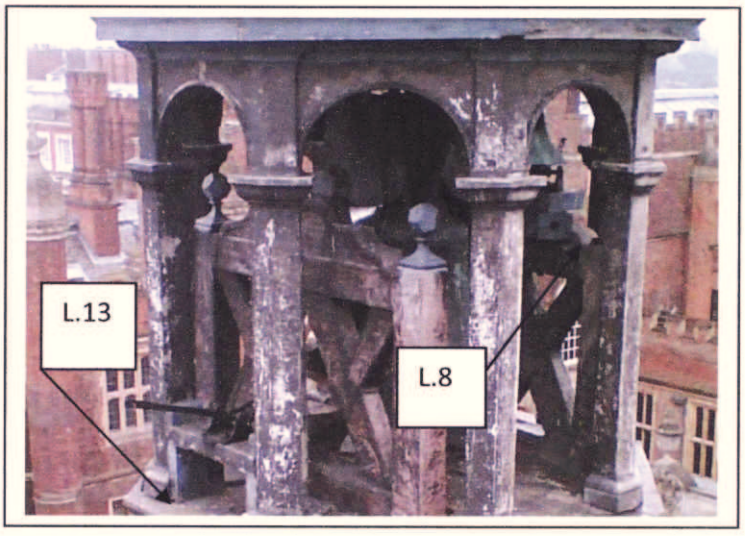
LANTERN SAMPLES

L.1 Exterior – upper part of cornice, north side
L.2 Exterior – bottom of cornice, north side
L.5 Exterior – lead on SW post, under lightening conductor strip
L.7 Interior – ball finial, south east
L.8 Interior – lead on south bell frame – inner face
L.9 Interior – lead on south bell frame – outer face
L.10 Exterior – grey/black coating on lead from lantern posts, various locations
L.11 Exterior – loose piece of capital, with recent lead cladding removed, after dismantling
L.12 Exterior – loose piece of cornice, after dismantling

East elevation



L.13 Skirting from base of post, north side, east of central opening, behind C19th stool

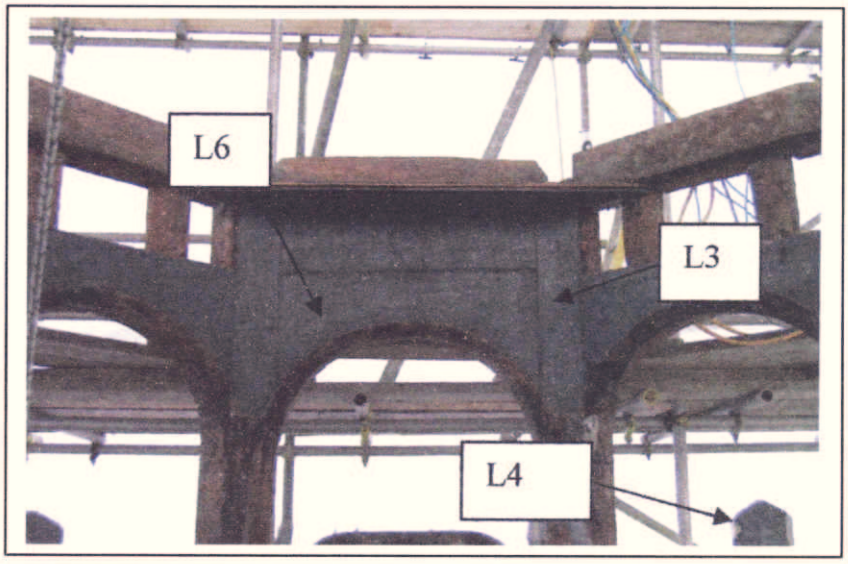


Interior

L.3 post above arch, north side

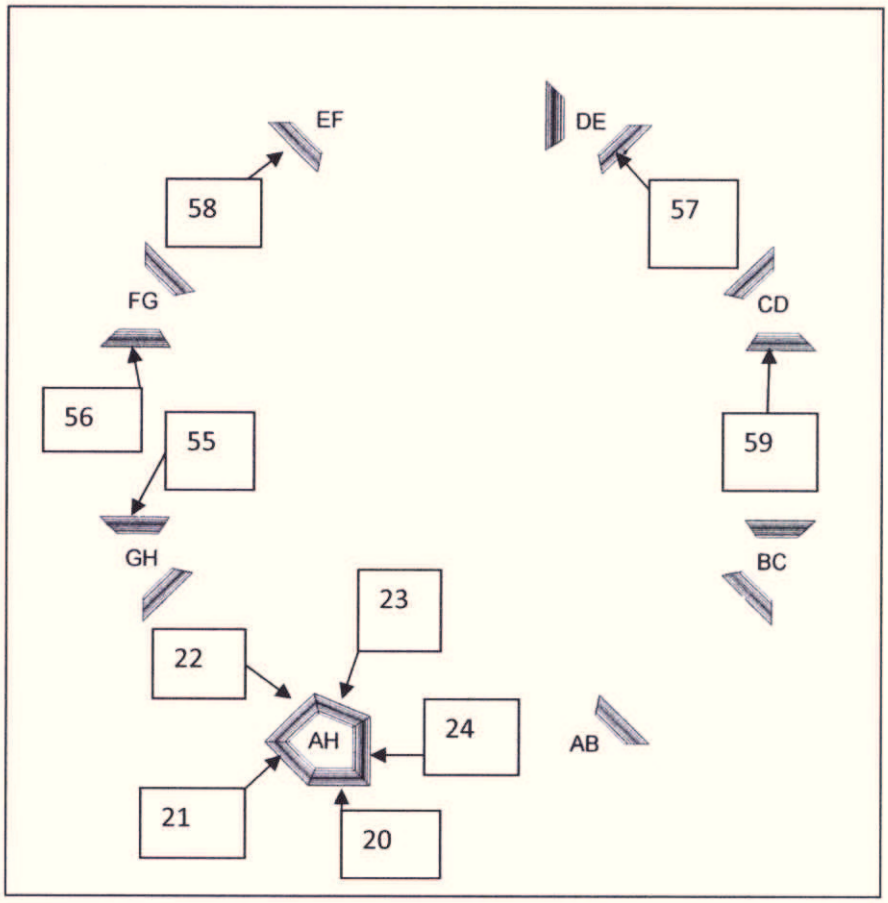
L.4 ball finial, north east

L.6 North side, panel above arch



Pieces of capital
Samples taken after dismantling

L.20 AH outer face
L.21 AH outer face
L.22 AH side
L.23 AH inner face
L.24 AH side
L.25 GH side
L.26 FG side
L.27 DE side
L.28 EF side
L.29 CD side



GILDED FINIAL SAMPLES

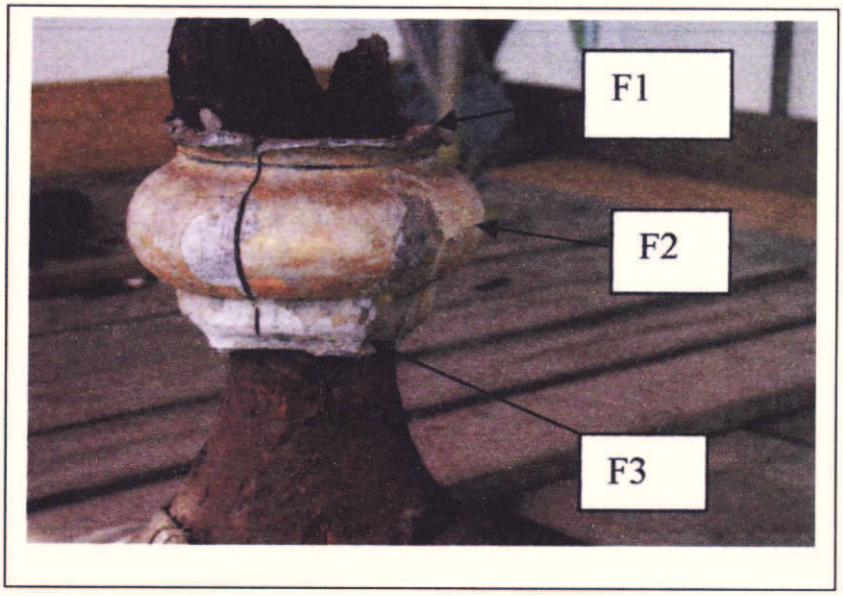
F.1 moulding above collar

F.2 collar

F.3 moulding below collar

F.4 lead 'apron' below finial upper part

F.5 lead 'apron' below finial lower part

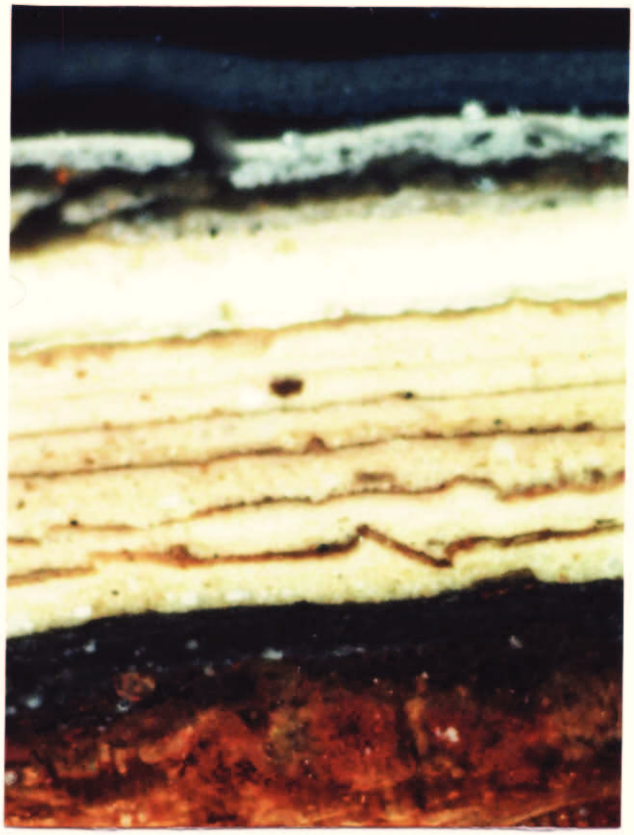


SAMPLE L.6
Lantern interior, south side above arch.

All layers with wood and original dark colours, then C19th stone colours, followed by early C20th pure white based on lead white.

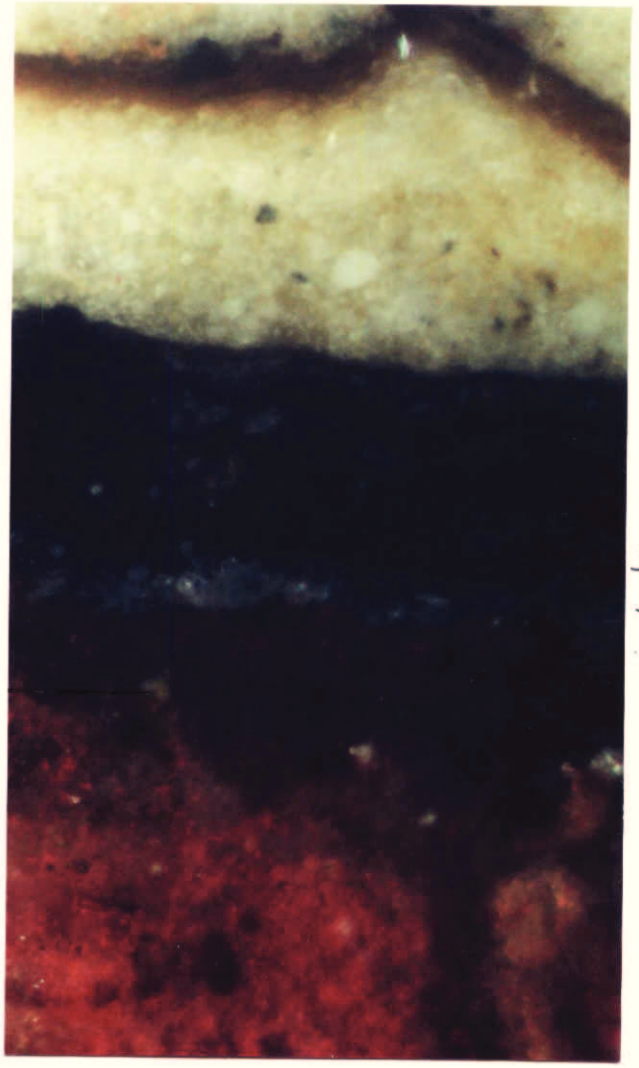
The final schemes are two degraded whites based on zinc white and two dark greys based on titanium white.

[x200]



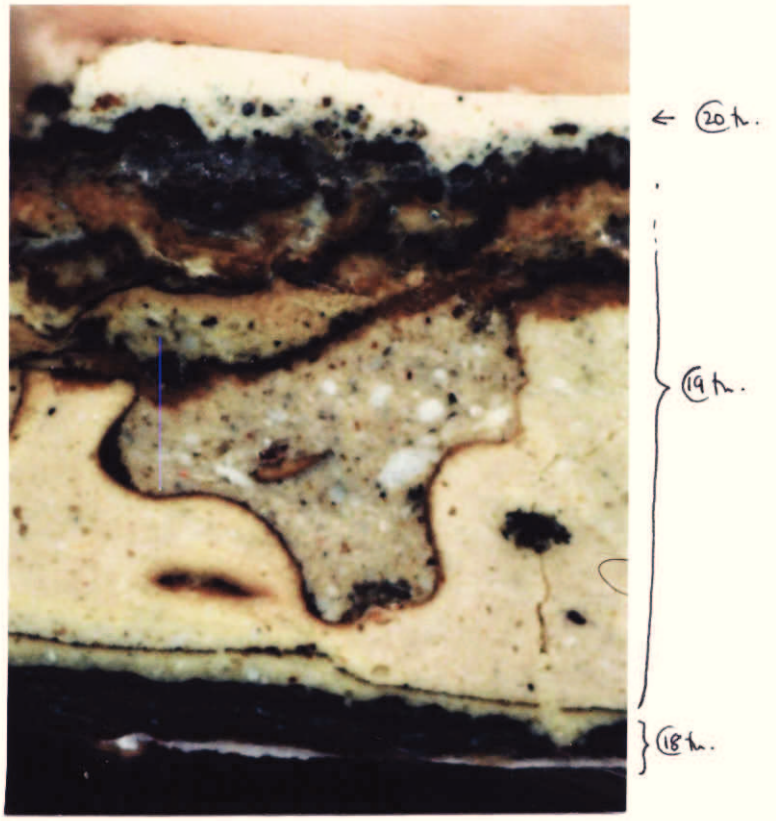
Detail of the original brown primer, with grey undercoat and grey/black top coat, followed by a further four grey/blacks.

[x500]



SAMPLE L.8
Interior of lantern, paint
on south bell frame

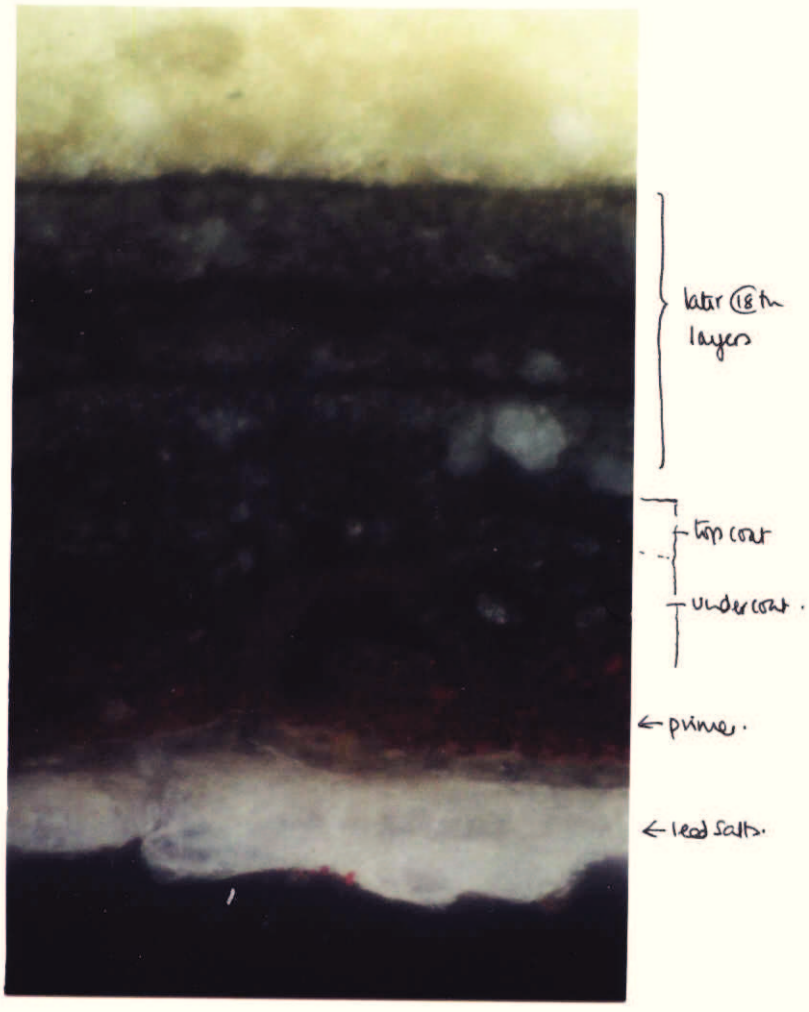
The stone coloured C19th layers are disturbed, but at the bottom we can see the original dark C18th layers in fine condition.



Detail of the bottom layers. Under the original primer is a coating of lead salts from the lead cladding of the bell frame.

This proves that the lead was painted from 1707

[x500]

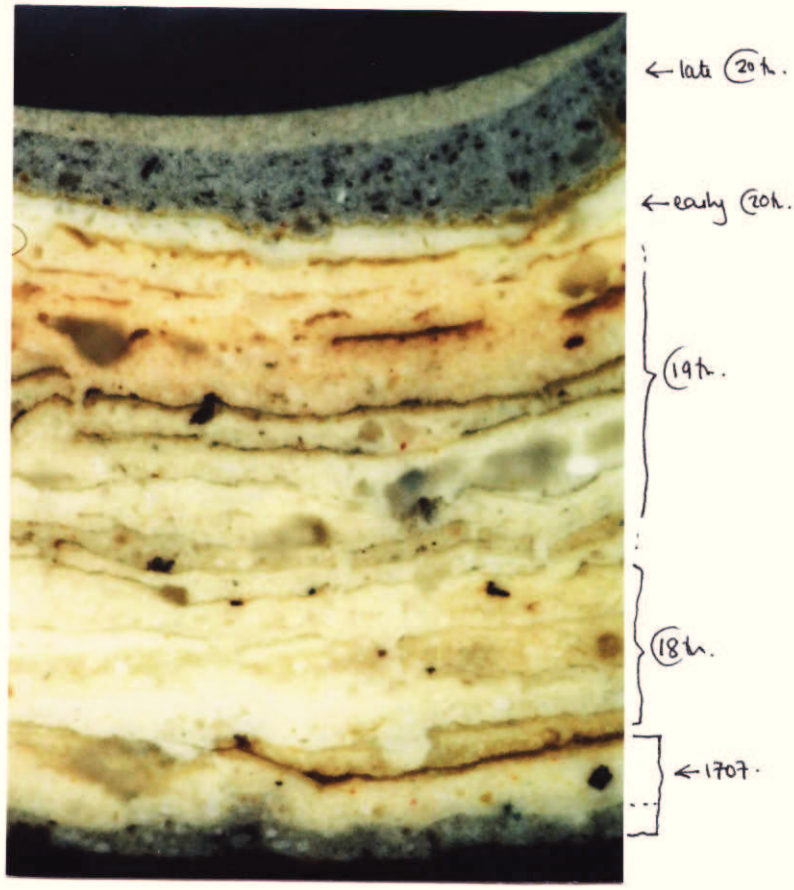


SAMPLE L.12
Exterior - piece of cornice

All layers, finishing with greys based on titanium white from the later C20th.

The degraded zinc-based layers from the early C20th are barely visible in this fragment.

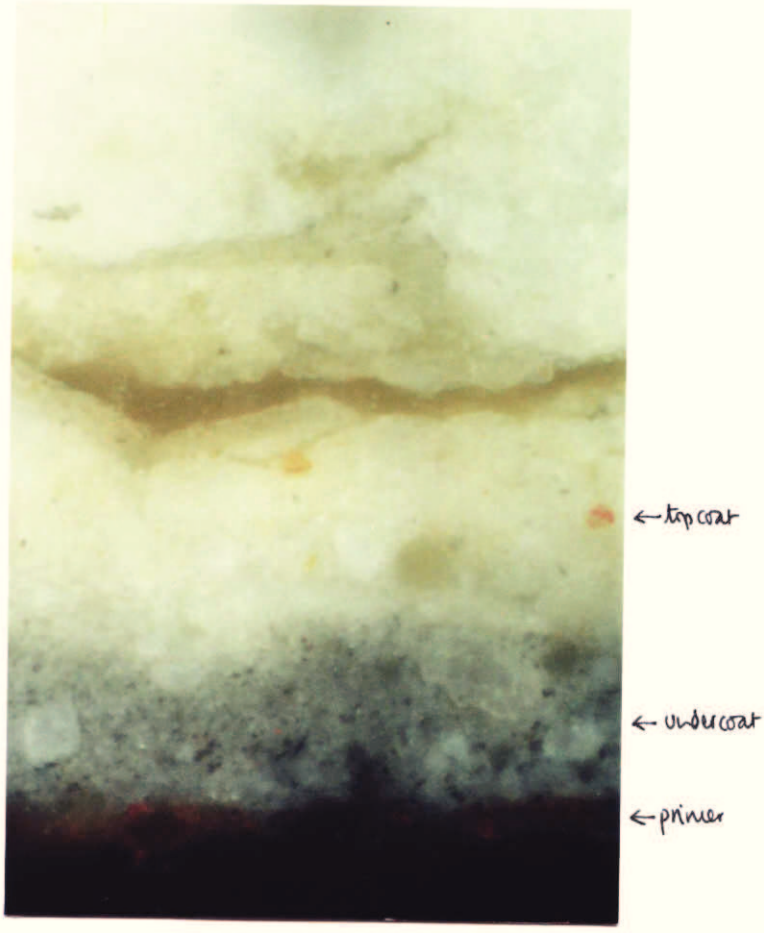
[x200]



Detail of the original stone-coloured paint scheme, over dark grey undercoat, and red iron oxide primer.

The stone –coloured paint is tinted with large particles of ochre and a little black.

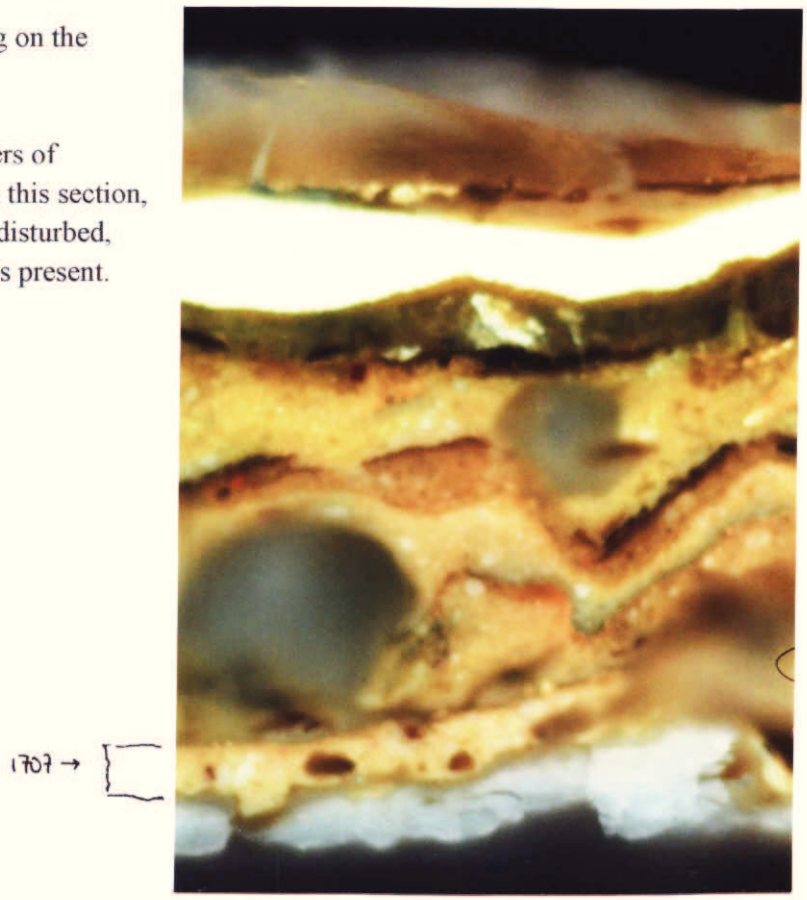
[x500]



SAMPLE F.2
Ball of finial – gilding on the lead.

Some of the later layers of gilding are missing in this section, and all the layers are disturbed, but the original gold is present.

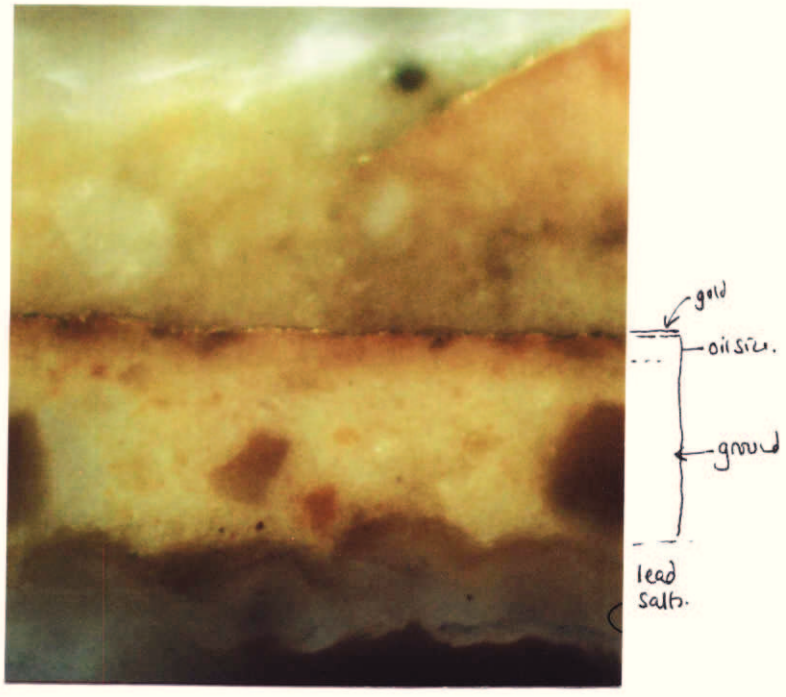
[x200]



Detail of the original gold, resting on a layer of lead salts.

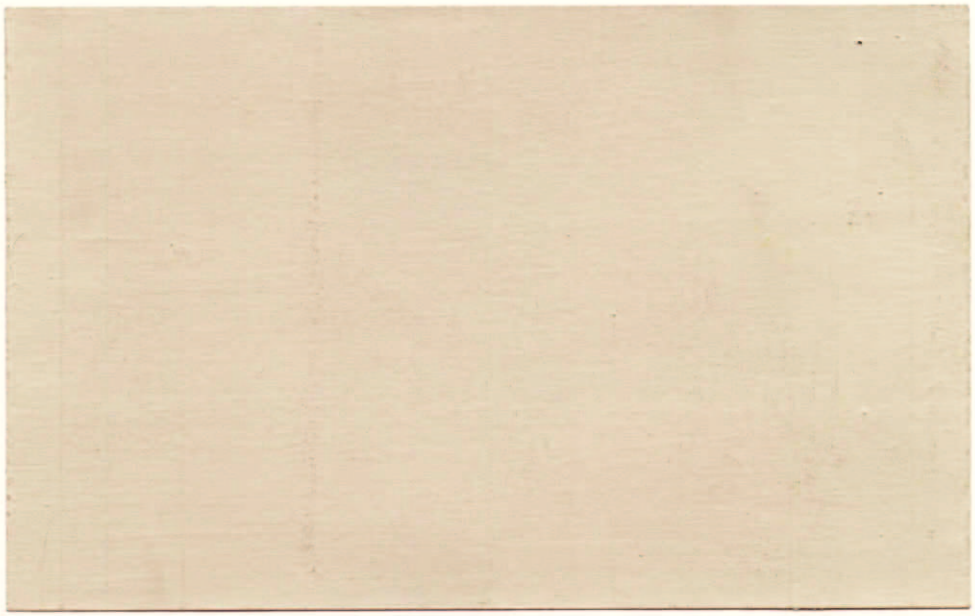
Under the gold leaf is the almost pure yellow ochre used for the oil size, and under that, the stone-coloured ground layer.

[x500]



1707 STONE COLOUR

USED ON ALL SURFACES, APART FROM THE BELL FRAME, THE BELL CROWN, AND THE INTERIOR WALLS ABOVE THE ARCHES



ANNE BOLEYN GATEHOUSE CONSERVATION

ANALYSIS OF THE PAINT ON THE

BRICKWORK, SLATE CLOCK & LAMP

Contents of report :

C.Hassall, Paint Analysis
5, Patshull Road, London NW5 2JX

Report no. A112b
February 2008

GILDED NUMERALS ON SLATE CLOCK

The gilding has become very worn, but in the angles of the incised numerals, several layers of gold have survived. Scrapings were taken from the numerals 1, 2 and 3.

In some samples just the most recent lot of gold was found, but in others up to five lots of gold were identified.

The earliest gilding found

This involved a lead white ground containing a few particles of red lead. The gold leaf was applied over the white, using a dark yellow oil size of iron oxide yellow mixed with a little lead white.

It is impossible to date the gilding. The only clue is the presence of lead white in the oil size which means that it is likely to be no later than the early nineteenth century.

Later gilding layers

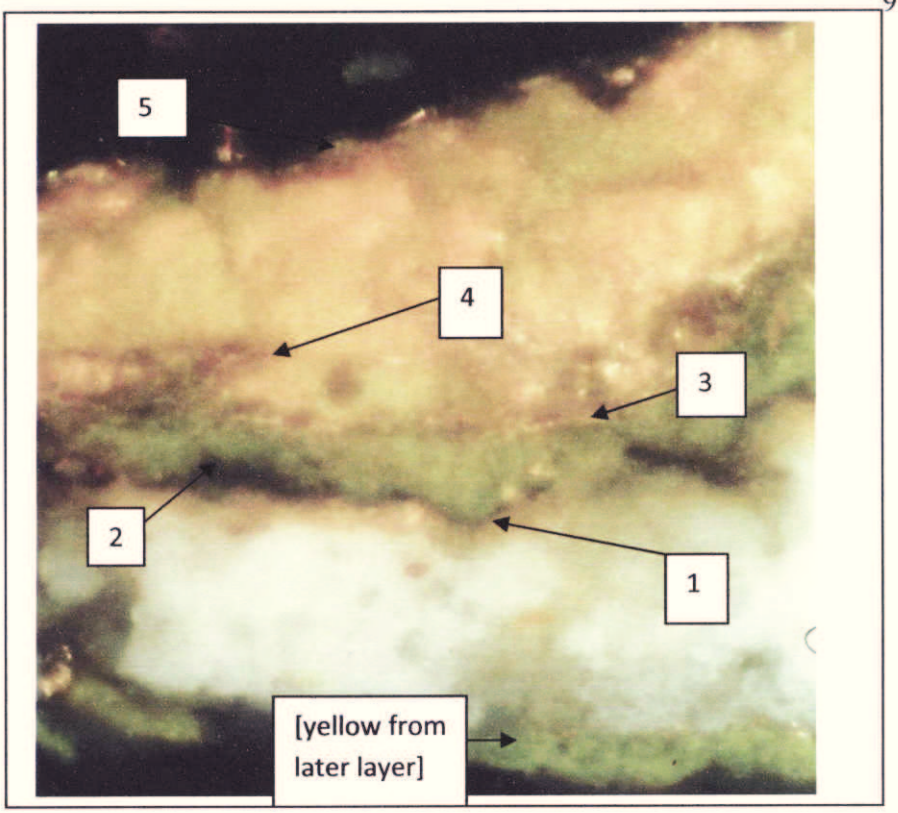
The first gilding was followed by gold leaf laid over a clear oil size. This type of oil size indicates that the gilding was carried out after the mid nineteenth century.

The last three gildings involved yellow oil size based on pure yellow iron oxide.

SAMPLE slate.1
From numeral 1

[x 500]

9



PAINTED BRICK DIAPER PATTERN - WEST WALL, EAST ELEVATION

The painted decoration has become matt and powdery, and is therefore quite difficult to see. It was thought that it might be possible to revive the colour by applying some kind of coating or consolidant. A sample was therefore taken from some of the black paint, so that the medium could be identified.

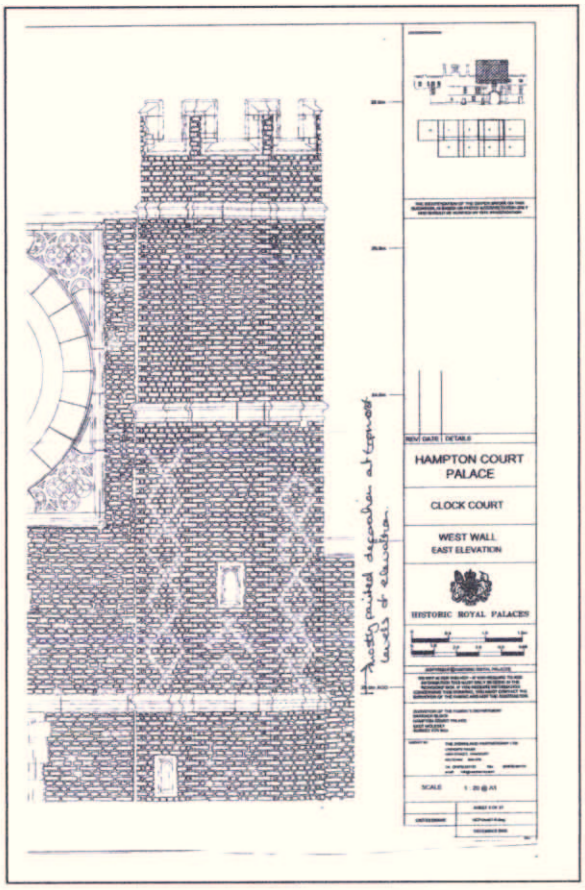
Organic analysis

Most of the sample was sent to Dr Brian Singer of Northumbria University for analysis using infra-red spectroscopy [FTIR] and gas chromatography/mass spectrometry [GC-MS].

The results of the analysis are included at the end of this report [p.12].

Dr Singer's conclusion is that the medium was **linseed oil.**

[in the GC-MS chromatogram the azelate to palmitate ratio confirms the presence of a drying oil, and the palmitate to stearate ratio is within the range for linseed oil].



There were also features indicating the presence of dimethylphthalate and dimethyl terephthalate which could indicate either the presence of a modern alkyd paint or contamination of the sample by plasticisers. As the paint is clearly not an alkyd, and the black paint fragments were transported in a plastic sample container, those anomalous features must be the result of sample contamination.

Cross-section analysis [see Sample brick.5 page 10]

The section showed four layers of paint: two white, one grey and finally a thin layer of black on top. The layers were mixed from lead white and charcoal black. As the medium was an oil paint, the use of lead white is not surprising.

These layers did not match up with any of those found on bricks below the terracotta plaques, or with those found used for the painted diaper brick pattern on the exterior wall of the Chapel.

PAINTED BRICKS BELOW TERRACOTTA ROUNDELS

When the plaques associated with each of the four terracotta roundels were removed, paint depicting brickwork was found to have survived underneath.

A different type of paintwork was found under each plaque. Presumably each was associated with a different period of construction, or episode of repair.

The wall behind the NE plaque had white chalk lines over bright red iron oxide and brick dust.

The wall behind the SE plaque had plain bright red iron oxide only.

The wall behind the SW plaque had carbon black lines over a dark reddish brown iron oxide.

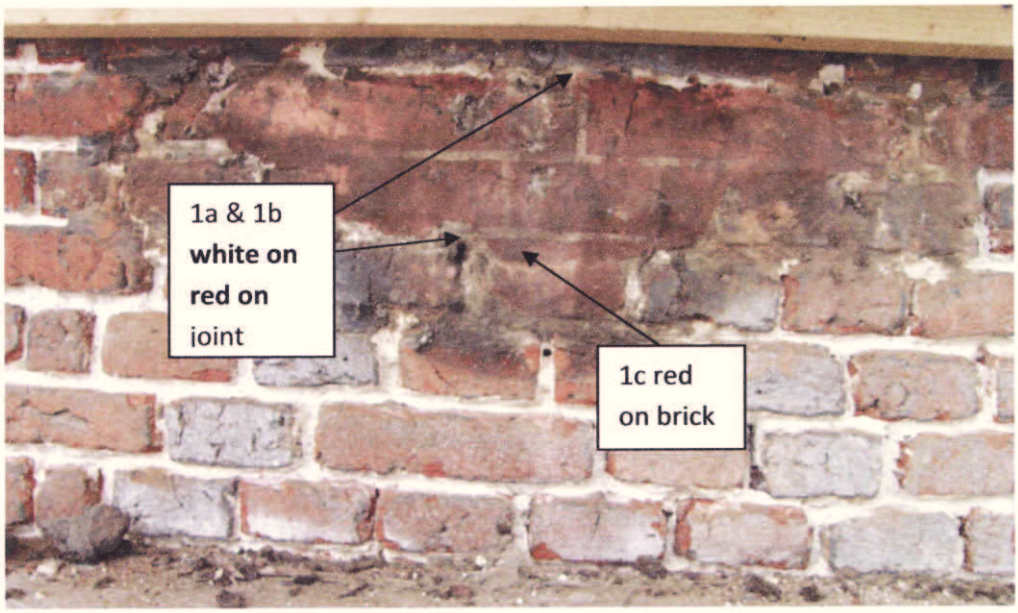
The wall behind the NW plaque had plain dark red iron oxide only.

1 - NE Plaque [see Sample brick.1, p.7]

The mortar, which is lime based and contains numerous sand particles, appears to have been partly smeared across the edges of the bricks to create a flat surface, then a thin layer of red was painted over the face of the wall . White lines representing the pointing, were then drawn over the top.

The red used for the background colour [Sample 1c] was a mixture of red iron oxide and crushed brick powder which involved a lot of fine silicate or sand particles.

The white used for the lines was pure calcium carbonate, and must therefore have been in an aqueous medium. It could even have been a limewash .



2 - SE Plaque [see Sample brick.2, p.8]

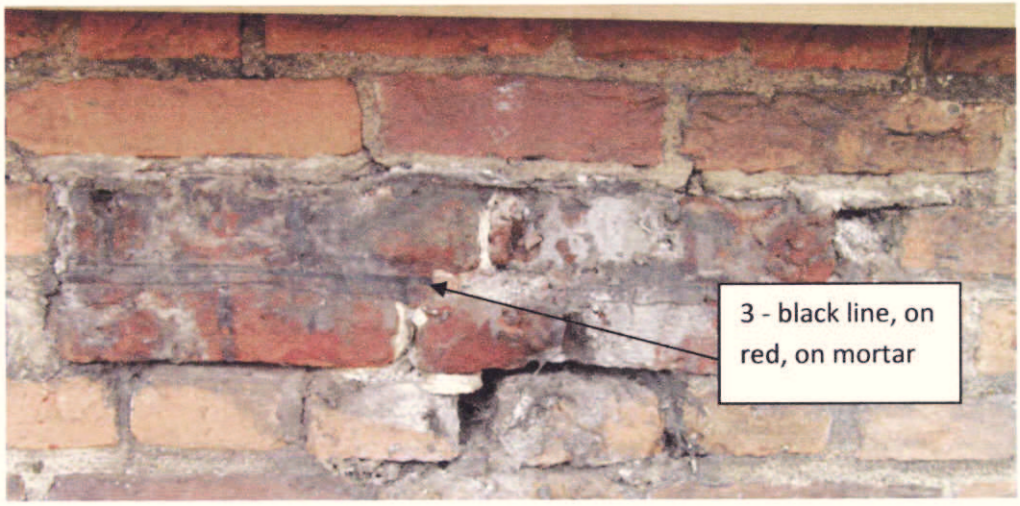
There were no painted lines on this patch of bricks, however, as on the NE plaque, on the previous page, the mortar appears to have been smeared across the brick edges.

The red was a pure, bright red iron oxide, containing no sand particles or brick dust.

3 SW Plaque [see Sample brick.3, p.8]

The cross-sections show a very solidly painted decorative scheme applied in three layers: first a dark brown based on brown iron oxides, then a more reddish brown of red and yellow iron oxides, and finally black lines of carbon black and a little lead white.

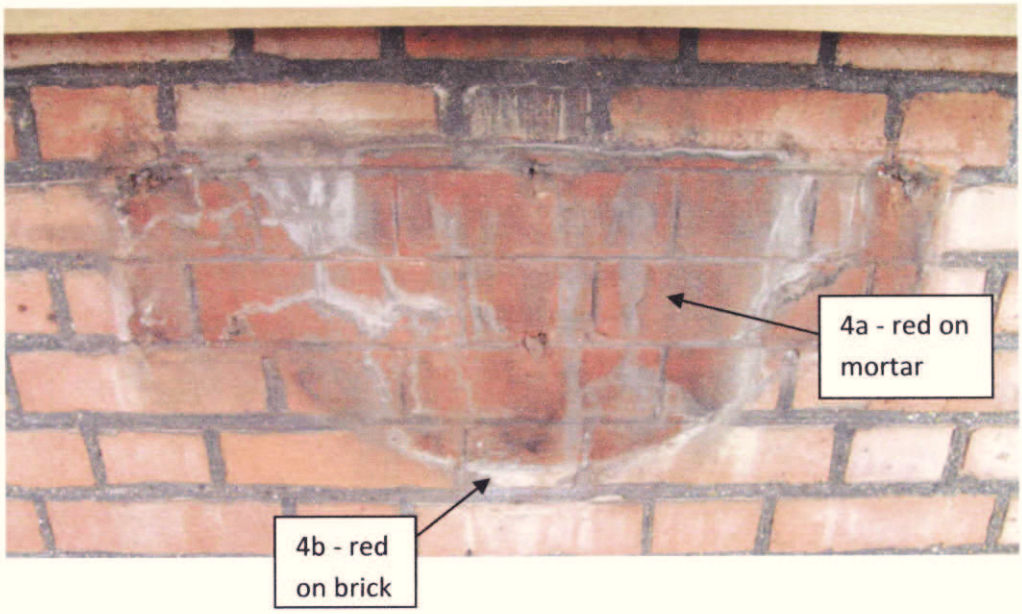
No organic analysis was carried out, but the inclusion of lead white in the black suggests the medium was oil. Oil paint based on pure carbon black dries badly, and until the later nineteenth century, and the introduction of chemical drying agents, metal-based pigments such as lead white, or iron oxide, had to be added as a catalyst.



4 - NW Plaque [see Sample brick.4, p.9]

The edges of these bricks were never cut back, and there are just thin lines of mortar in the joints.

The coating which was brushed equally over bricks and mortar, consisted of a thin layer of a reddish brown based on a very dark red iron oxide, containing large particles of pure haematite and a few particles of carbon black.



PAINTED DIAPER PATTERN ON CHAPEL EXTERIOR

Five samples were taken from the painted diaperwork of the exterior Chapel wall, for comparison with the painted diaperwork on the Anne Boleyn Gatehouse.

chapel.1 – white on red on brick

chapel.2 – white on black on mortar

chapel.3 - white on red on mortar

chapel.4 – red on brick

chapel.5 – black on brick

Organic analysis was carried out on the Gatehouse diaperwork, and the medium was found to be linseed oil. The white pigment used there was lead white, which is what one would expect for oil paint. The only other area where lead white was used was under the SW plaque, and that patch of paintwork is also likely to have been executed in oil

Oil is unlikely to have been used for the Chapel diaperwork. The white paint was pure calcium carbonate, and calcium carbonate was also mixed with the black used for the dark bricks. As calcium carbonate is translucent in oil, the medium for this painting would have to have been an aqueous one.

The pigments used for the Chapel wall consisted of a finely-ground charcoal black, a very pure, bright red iron oxide, and a calcium carbonate white [see cross-sections p.8]. The white could have been a limewash, but the paint dispersions revealed numerous coccoliths, which points to natural chalk

Comparison with pigments used on the Gatehouse

Calcium carbonate [probably chalk] was used for white lines under the NE plaque.
Charcoal black was used in oil for the Gatehouse diaperwork, and in oil under the SW plaque.
The red most similar to the Chapel red was found under the SE plaque.

The dark red iron oxide found under the NW plaque, and the bright red iron oxide mixed with brick dust, found under the NE plaque, did not match any other found in this investigation.

BASE COURT LANTERN LAMP

Two lamps of the same design were examined: one from the Base Court, the other from a different area. Both are currently painted black, and were examined in a store room in the Works Yard.

By scraping the surface with a scalpel, it was found that there was very little paint on either lamp. Several samples were taken from both, some from the lantern parts, and some from the bases, where there appeared to be more layers.

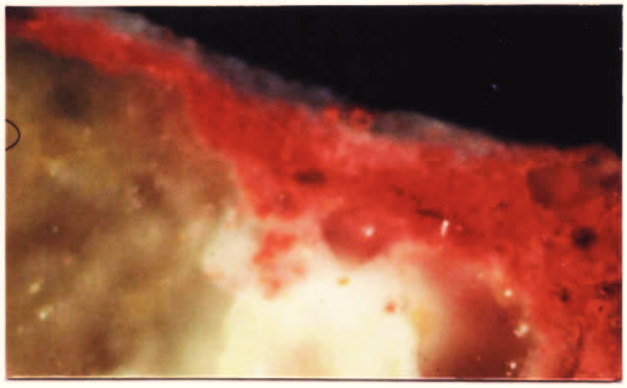
Just one late twentieth-century paint scheme was found on the Base Court Lamp, over a white undercoat based on titanium dioxide white. The ironwork under the paint appeared rusty, and the painting must have been carried out some years ago.

The other lamp had two paint schemes on it, and was in better condition. It was clear that the iron had been cleaned back to bright metal on the penultimate occasion that it was painted. After paint stripping, the iron was coated with two layers of primer: the first containing metallic particles, the second based on a pure red iron oxide. It was then painted black. The second paint scheme, which is the present decoration, was also black.

No trace of pre-twentieth-century paint was found on either lamp.

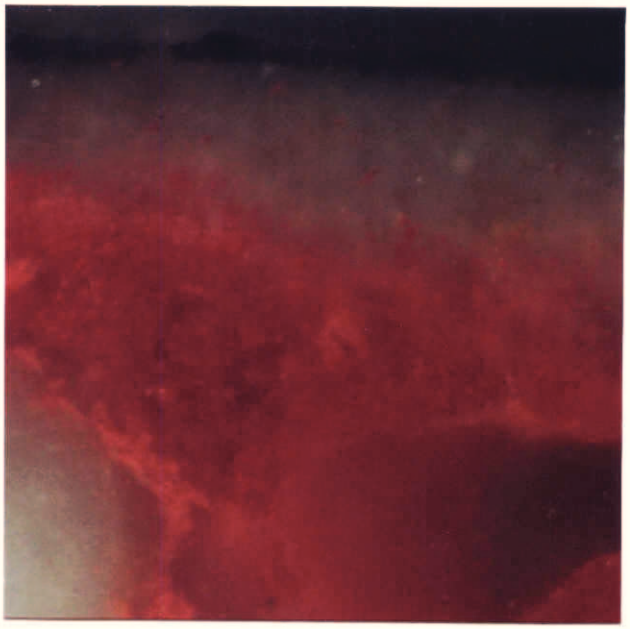
SAMPLE brick.1a
NE plaque - white on red

[x200]



Detail, showing calcium carbonate white over red iron oxide containing brick dust and sand

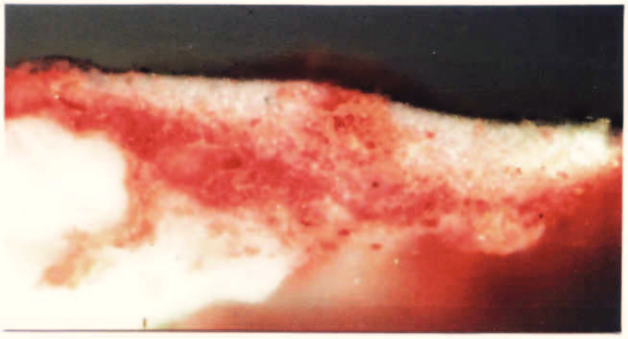
[x500]



SAMPLE brick.1b
NE plaque - white on red

Showing clearly that the white and the red are contemporary

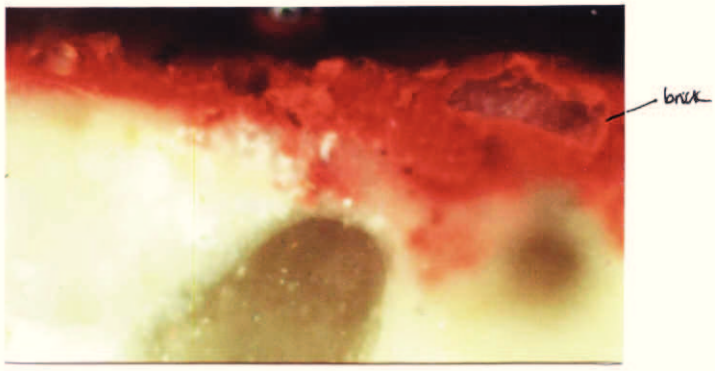
[x200]



SAMPLE brick.1c

NE plaque – red

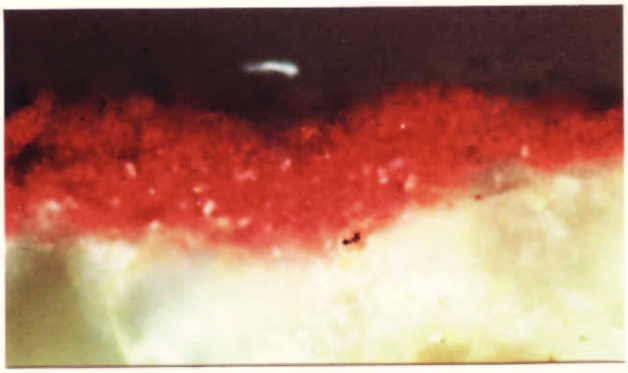
lots of brick particles in the red. [x200]



SAMPLE brick.2
SE plaque

Pure, bright red iron oxide – no brick particles, and no impurities

[x200]

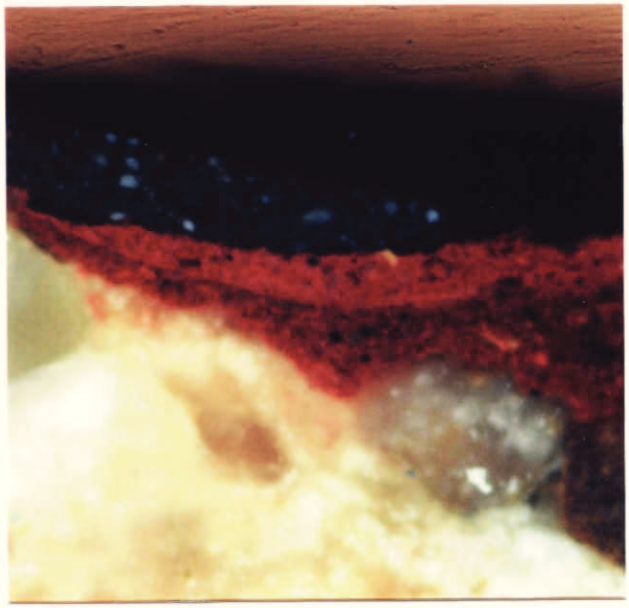


SAMPLE brick.3
SW plaque

The black lines are a mixture of carbon black and lead white. Underneath are two layers of dark red/brown containing a mixture of iron oxides.

Because of the lead white the medium is likely to have been oil

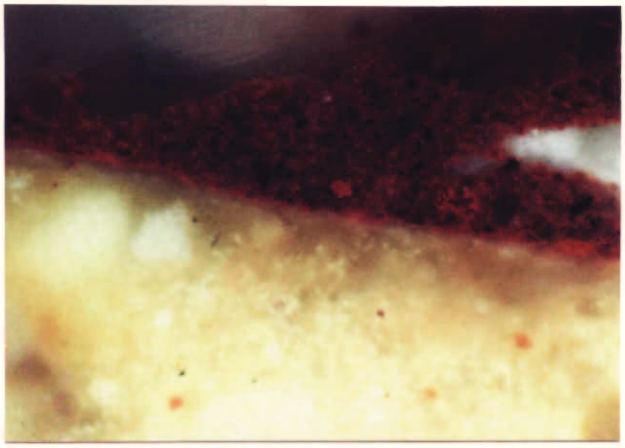
[x200]



SAMPLE brick.4a
NW plaque
Red on mortar

A very dark red/brown
iron oxide.

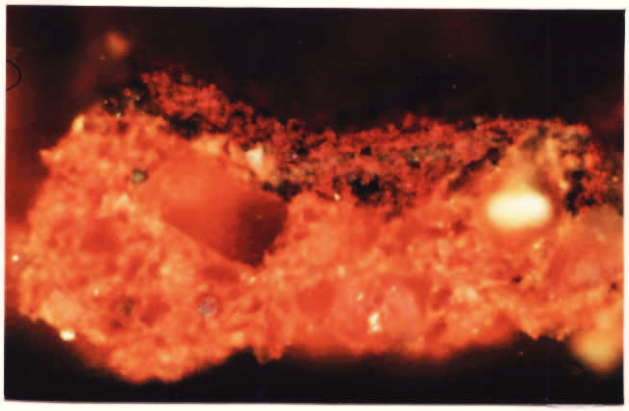
[x200]



SAMPLE brick.4b
NW plaque

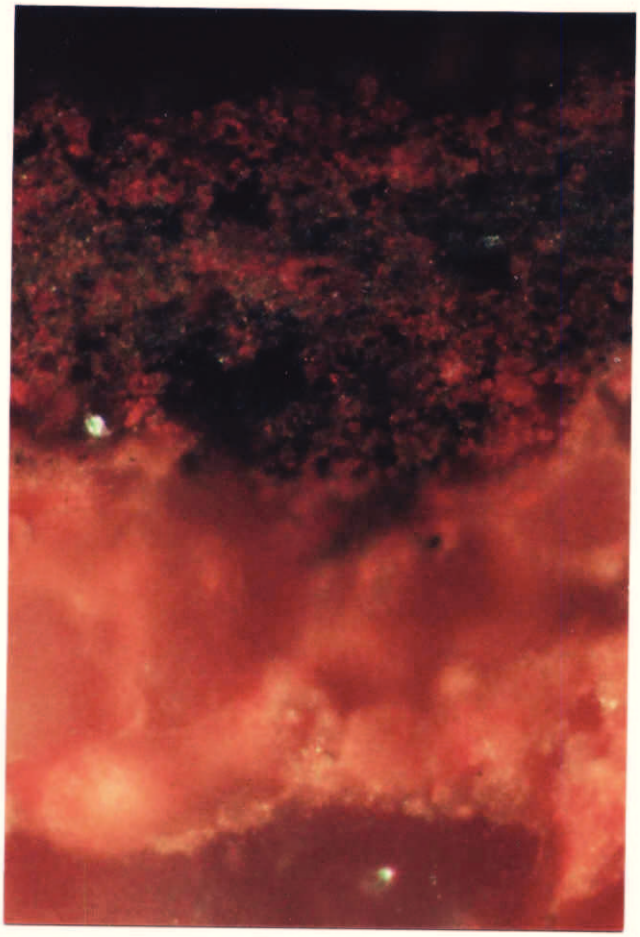
Red on brick

[x200]



Detail. The dark particles are
lumps of pure haematite,
but there is also a little black.

[x500]

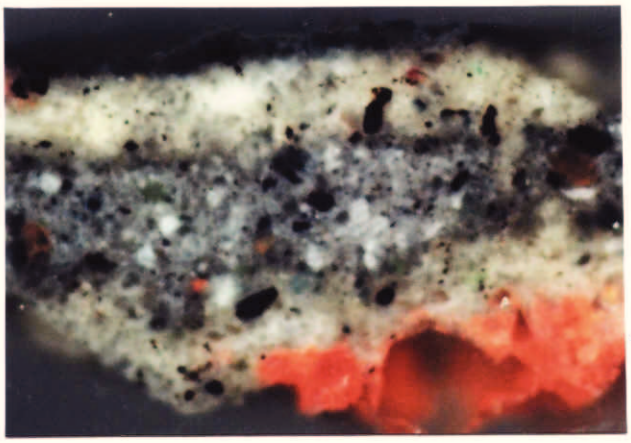


PAINTED DIAPER WORK ON THE WEST WALL OF THE ANNE BOLEYNE GATE
Taken from the same area as the sample sent for organic analysis.

SAMPLE brick.5

Four layers mixed from lead white and charcoal black.

[x200]



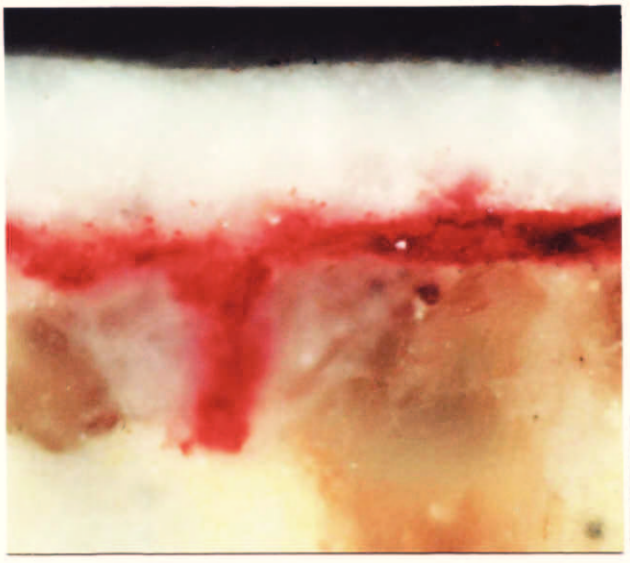
PAINTED DIAPER WORK ON THE CHAPEL EXTERIOR WALL
For comparison with the painted brickwork on the Ann Boleyne Gate

SAMPLE chapel.3
White painted line over red, on mortar

A very similar pure red iron oxide to that used under the SE plaque.

The white is calcium carbonate.

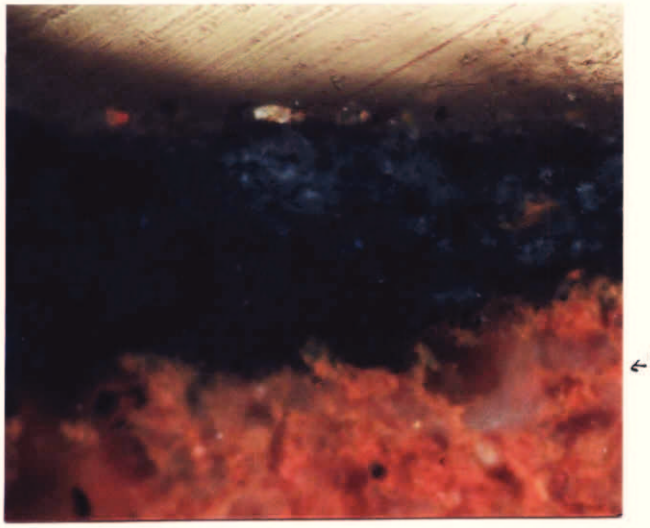
[x200]



SAMPLE chapel.5
Black painted line on brick

Calcium carbonate and charcoal black

[x200]



EXAMINATION PROCEDURE

The samples were examined under low powered magnification, then part of each was mounted in cold-setting polyester resin for cutting and polishing as a cross-section.

The cross-sections were viewed at magnifications up to x500, using a Zeiss Axioscop microscope.

Paint from the coloured layers and the white layers was dispersed on glass slides using 'meltmount' resin, and the pigments identified using a Zeiss polarising light microscope at magnification x1000.

A chemical test for lead [lead nitrate/lead iodide] was carried out on white layers in the cross-sections

Medium analysis

A larger sample of black paint from the painted diaperwork on the west wall of the Gatehouse was collected. This was later examined under low magnification and the black separated from underlying layers and fragments of brick. The sample was sent to Dr Brian Singer of the University of Northumbria for organic analysis. The analytical techniques used by him are described in the report on page 12.

Unfortunately a plastic sample packet was used for the initial storing of the black paint sample and this partly contaminated the results. Despite this, it was still possible to identify the paint medium.

northumbria UNIVERSITY

Investigation of ~~two~~ paint samples ~~and one varnish sample~~ For Catherine Hassall

List of samples

Sample number	Taken by / date	Description of sample	Provenance
1	Catherine Hassell Jan 08	Paint from brickwork,	Hampton court

Purpose

The purpose of this investigation was to identify the media in the paints and varnish.

Experimental

Fourier Transform Infra-red (FTIR) Analysis

A Sample of each coating was placed onto the diamond window of a Durascope diamond ATR attachment linked to a Perkin Elmer 1000 Fourier transform Infra red spectrometer. The sample was pressed against the window using a metal anvil and scanned sixteen times. The background scan was automatically subtractedand the scans averaged to produce a spectrum. The three samples were thus analysed by reflectance FTIR.

GC-MS analysis of Oils/resins/waxes

Each sample was transferred to a Reactivial and was derivatised and subjected to chromatographic analysis by gas chromatography and mass spectroscopy (GC-MS). Each sample was heated with three drops of 5% methanolic solution of 3-trifluoromethylphenyltrimethylammonium hydroxide to 60°C for 5 hours. The mixture was then subjected to thermal decomposition at 250°C, before analysis by GC-MS in order to look for evidence of drying oils, waxes and resins in the paint. The GC-MS instrument used was a Thermo Focus fitted with a DSQ mass detector.

Protein/oil Analysis[1]

The sample of proteinaceous paint was hydrolysed with concentrated hydrochloric acid at 90°C for 3 days. The acid was removed under vacuum and the residue treated with propan-1-ol / dry HCl mixture at 110°C for 45 minutes. The excess reagent was evaporated under nitrogen at 50°C and the residue was dissolved in 5% triethylamine in dichloromethane. Pentafluoropropionic anhydride was added and the mixture was heated to 100°C for 15 minutes. The excess reagent was evaporated under nitrogen at room temperature and the residue was dissolved in dichloromethane. This procedure[1] yielded the propyl esters of the fatty acids derived with any oils present, together with the propylesters of the N-pentafluoropropanoyl derivatives of the amino acids from the proteins which were then analysed by GC-MS. The GC-MS instrument used was a Thermo Focus fitted with a DSQ mass detector.

Results and Discussion

Sample 1 Hampton Court

Infra red Spectroscopy

The initial investigation of the sample was carried out via FTIR spectroscopy.
The infrared spectrum (Figure 1) showed that sample 1 seemed to contain silicates, perhaps from the brickwork but no indication of any organic paint binder could be seen. However, since oil was expected a GC method which would analyse oils was chosen for further investigation.

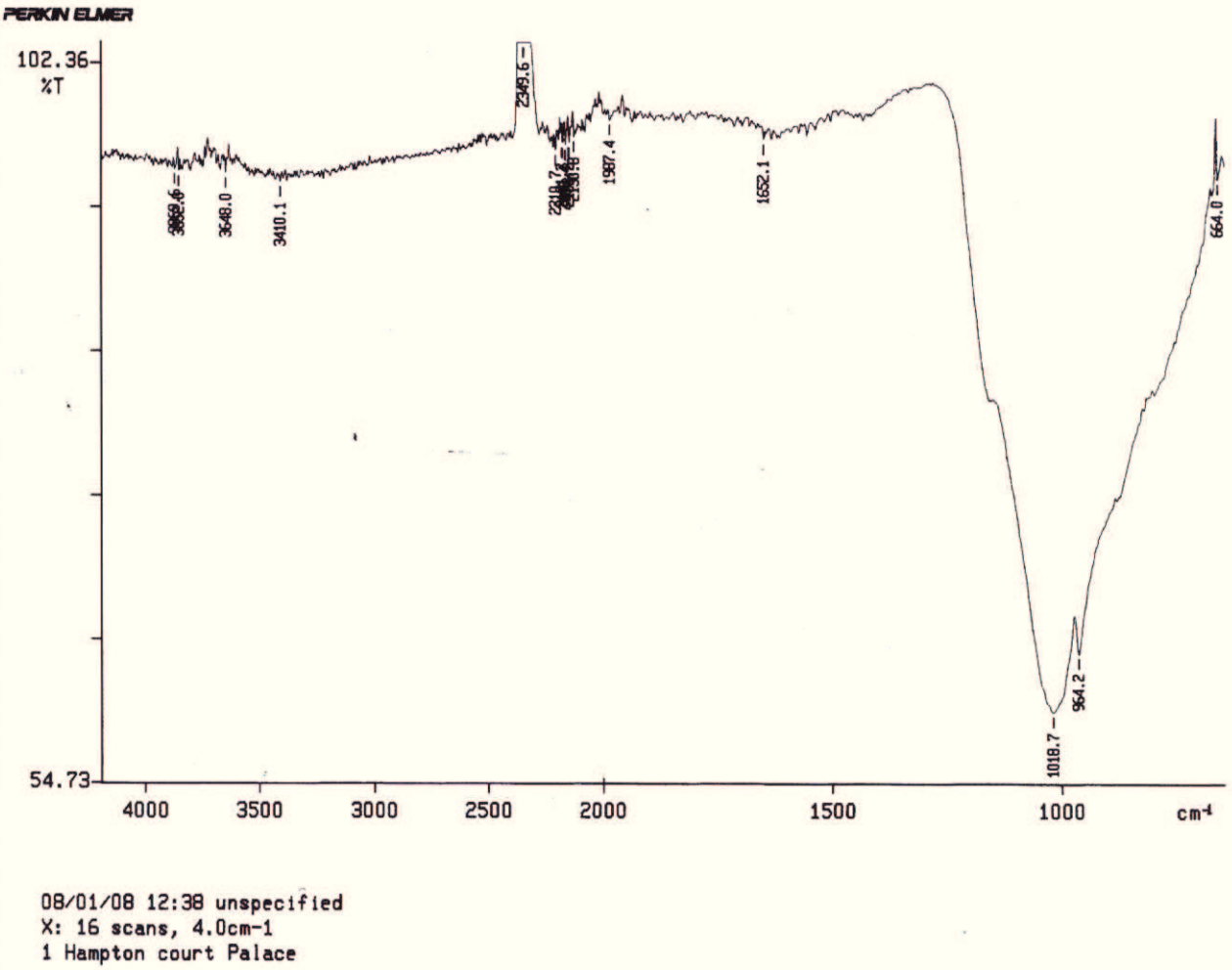


Figure 1 FTIR spectrum of sample1, Paint from Hampton Court

GC-MS analysis

Sample 1(appendix1) The GC-MS (chromatogram 1) gave a chromatogram showing mainly peaks for azelic acid, palmitic acid, stearic acid and smaller amounts of sebacic acid and suberic acid, as their methyl esters. This combination is typical of a drying oil. The azelate to palmitate (Az/P) ratio (table 1) is 0.92 which confirms the presence of a drying oil[2]. The palmitate to stearate (P/S) ratio is 2.01 which is within the range for linseed oil (table 2). However, there are also peaks for dimethylphthalate (9.57 minutes)and dimethyl terephthalate (10.53 minutes) which may indicate the presence of a modern alkyd paint layer based on linseed oil or a semidrying oil and phthalic anhydride and terephthalic acid.[or alternatively may indicate contamination of the sample with plasticisers].

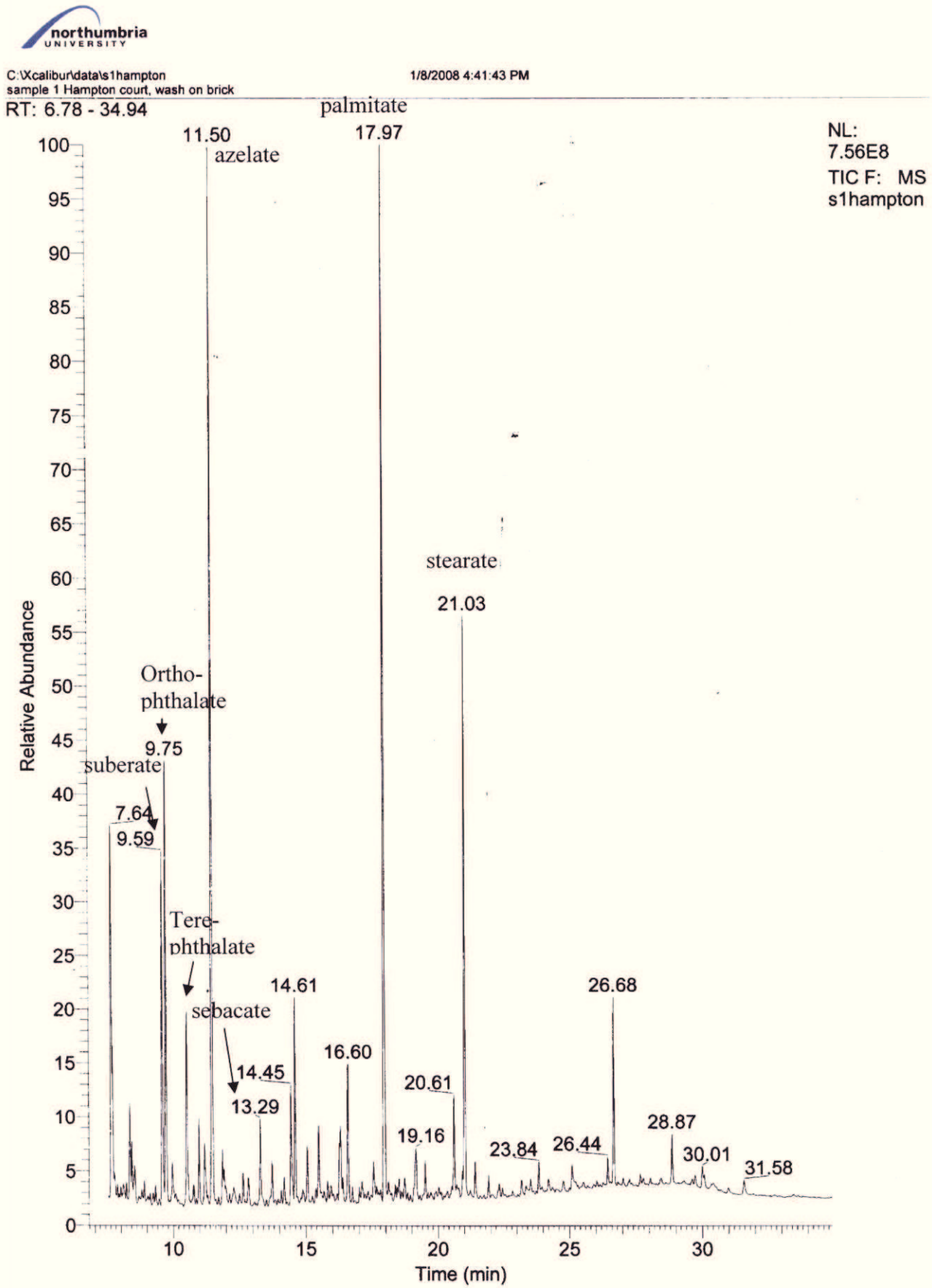
Az/P	0.92
Az/Sub	2.88
Az/Seb	10.4
P/S	2.01

Table 1: ratio of acids in sample 1 by peak area

oil	P/S ratio [2]	P/S ratio[3]	P/S ratio[4]
linseed oil	1.1 - 2.3	1.5	1.1 - 2.1
walnut oil	2.2 - 3.6	2.5	2.5 - 4.2
poppy oil	2.9 - 3.7	5.0	2.9 - 6.5
egg	-	3.0	1.7

Table 2: Palmitate to Stearate ratios for artists' media

The azelate to sebacate and azelate to suberate ratios (table 1) suggest that this oil has been partially heat bodied[5]. (If the azealate /suberate ratio is around 2 and the azelate / sebacate ratio is around 4, then this is an indication that the oil has been heat bodied[5]. If the azelate /suberate ratio is around 7 and the azelate / sebacate ratio is around 25, then the oil has probably not been heat bodied[5]. Other authors[4] claim that quantities of sebacic acid and suberic acid in the sample increase with age while the azelaic acid content does not. Hence an older sample which originally contained raw oils might be confused with a heat bodied sample.)

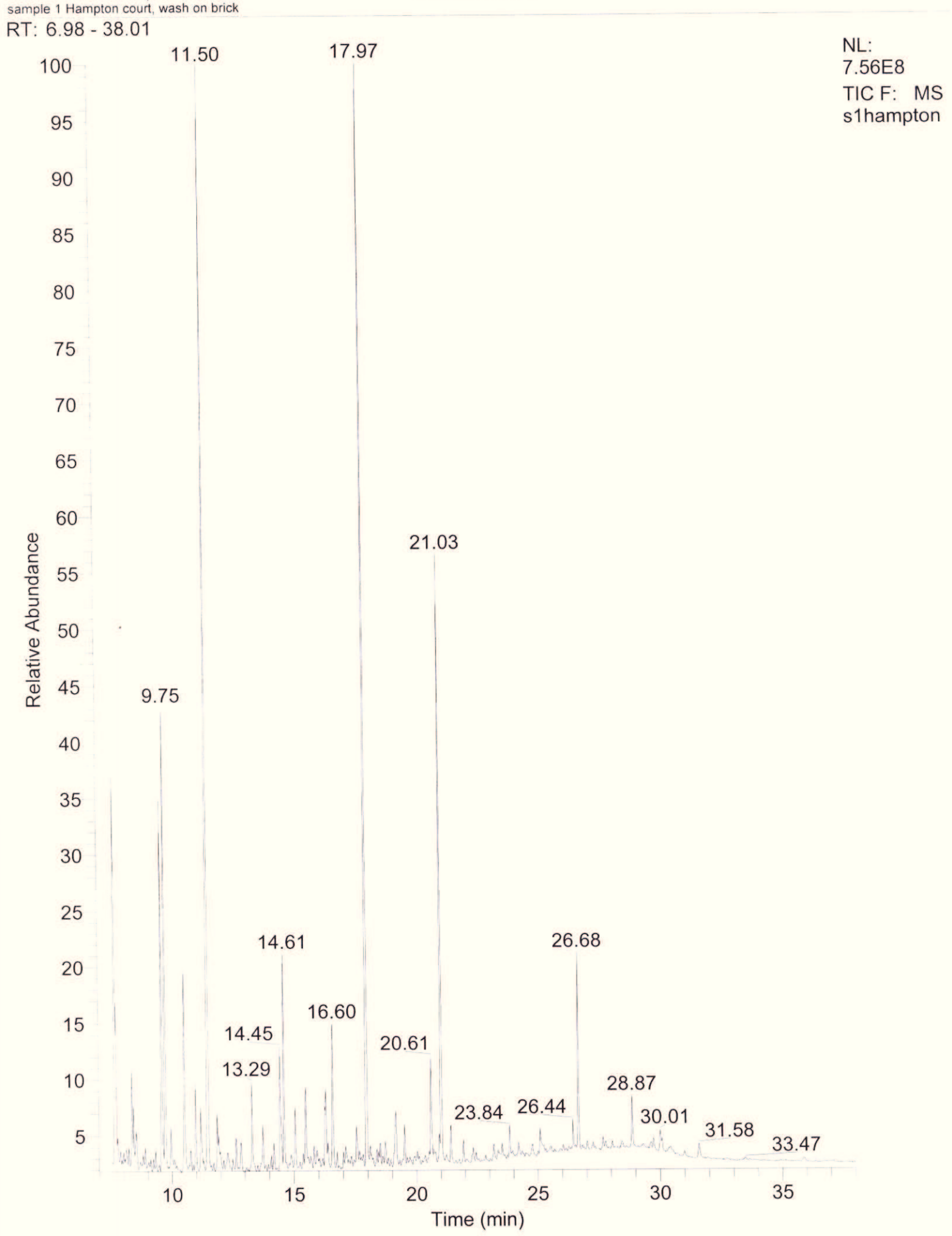


Chromatogram 1 Sample 1 from Hampton Court

Appendix 1
GC-MS data for sample 1

C:\Xcalibur\Data\s1hampton
sample 1 Hampton court, wash on brick

1/8/2008 4:41:43 PM



Hit	SI	RSI	Prob	Name
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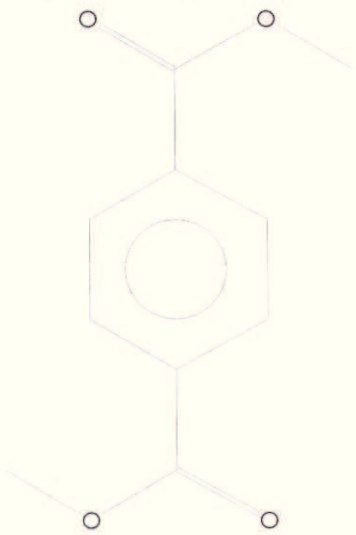
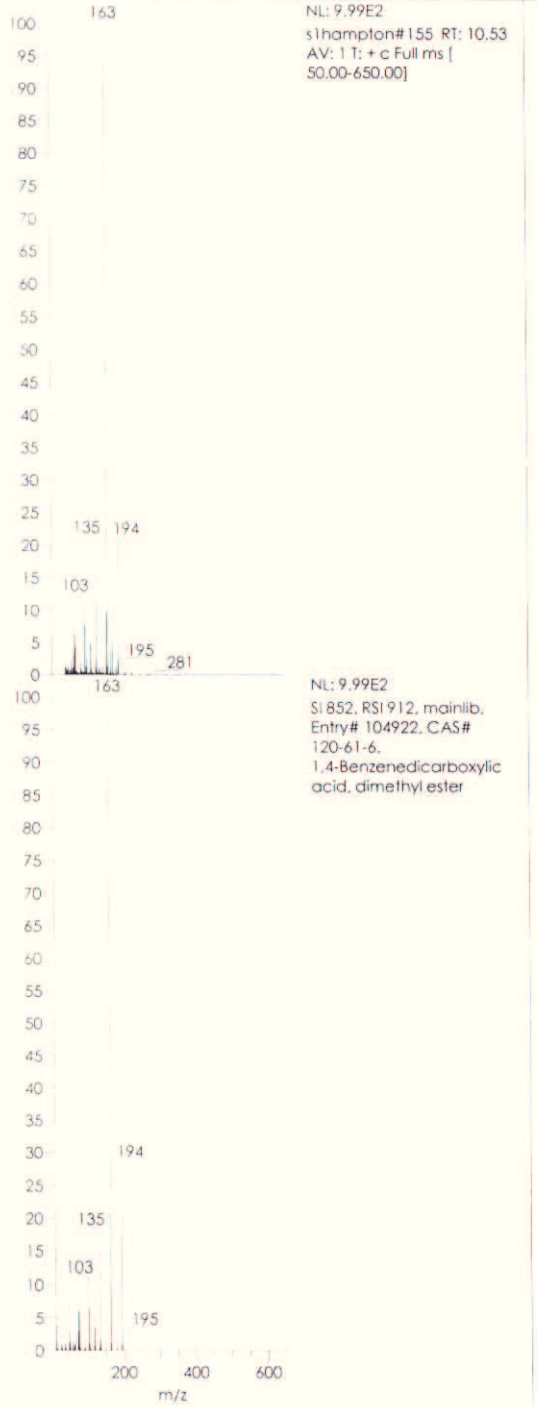
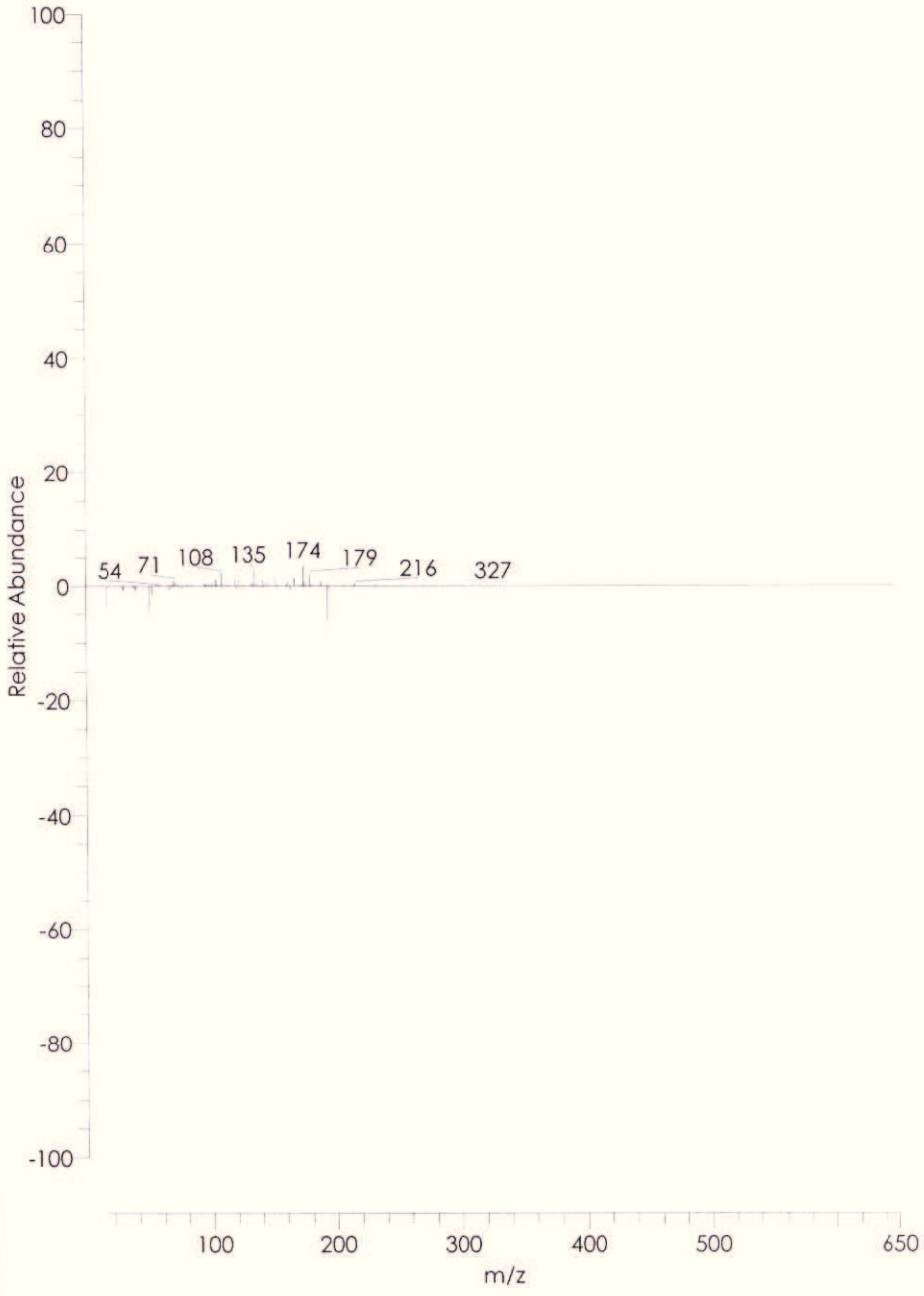
3	851	910	67.83	1,4-Benzenedic
4	848	927	67.83	1,4-Benzenedic
5	842	898	67.83	1,4-Benzenedic
6	803	853	13.93	1,3-Benzenedic
7	802	875	13.39	Benzene-1,4-dic
8	802	875	13.39	Benzene-1,4-dic
9	800	857	13.93	1,3-Benzenedic
10	796	850	13.93	1,3-Benzenedic
11	796	850	13.93	1,3-Benzenedic
12	753	817	2.75	Terephthalic ac
13	753	817	2.75	Terephthalic ac
14	724	796	0.77	Dimethyl phthal
15	724	796	0.77	Dimethyl phthal
16	715	856	0.77	Dimethyl phthal
17	714	780	0.77	Dimethyl phthal
18	707	767	0.77	Dimethyl phthal

1,4-Benzenedicarboxylic acid, dimethyl ester
Formula C10H10O4, MW 194, CAS# 120-61-6, Entry# 104922
Terephthalic acid, dimethyl ester





Raw data - Library entry



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2	901	931	61.70	Dimethyl p	mair
3	880	909	61.70	Dimethyl p	replil
4	872	901	61.70	Dimethyl p	replil
5	871	922	61.70	Dimethyl p	replil
6	867	949	15.82	Fenuron	nist_1
7	842	912	4.82	Phthalic ac	mair
8	842	912	4.82	Phthalic ac	MAIN
9	830	897	3.21	2-(Methylm	nist_1
10	819	887	2.20	Phthalic ac	mair
11	819	887	2.20	Phthalic ac	MAIN
12	815	887	1.86	Phthalic ac	mair
13	815	887	1.86	Phthalic ac	MAIN
14	805	872	1.31	Phthalic ac	MAIN
15	805	872	1.31	Phthalic ac	mair
16	802	870	1.16	Phthalic ac	mair
17	802	870	1.16	Phthalic ac	MAIN
18	797	866	0.93	Phthalic ac	MAIN

Dimethyl phthalate
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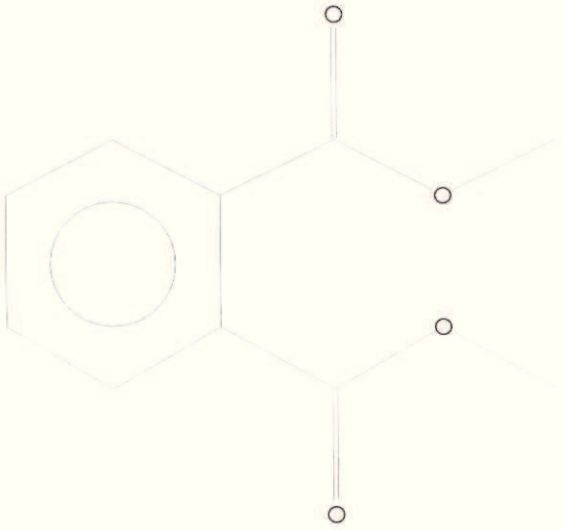
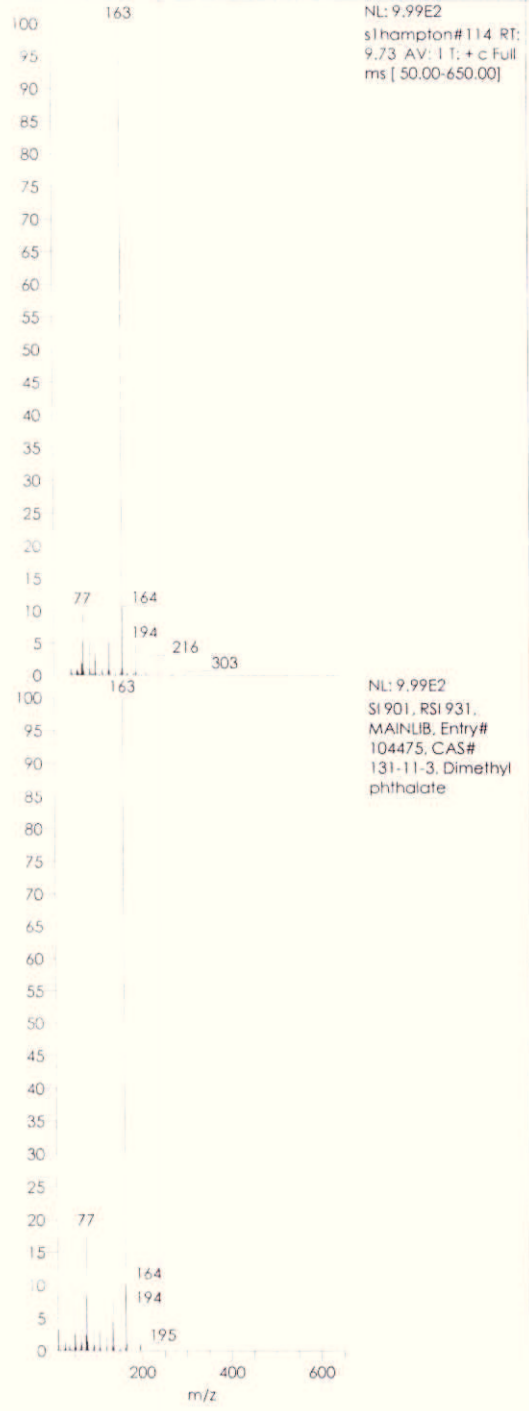
1,2-Benzenedicarboxylic acid, dimethyl ester





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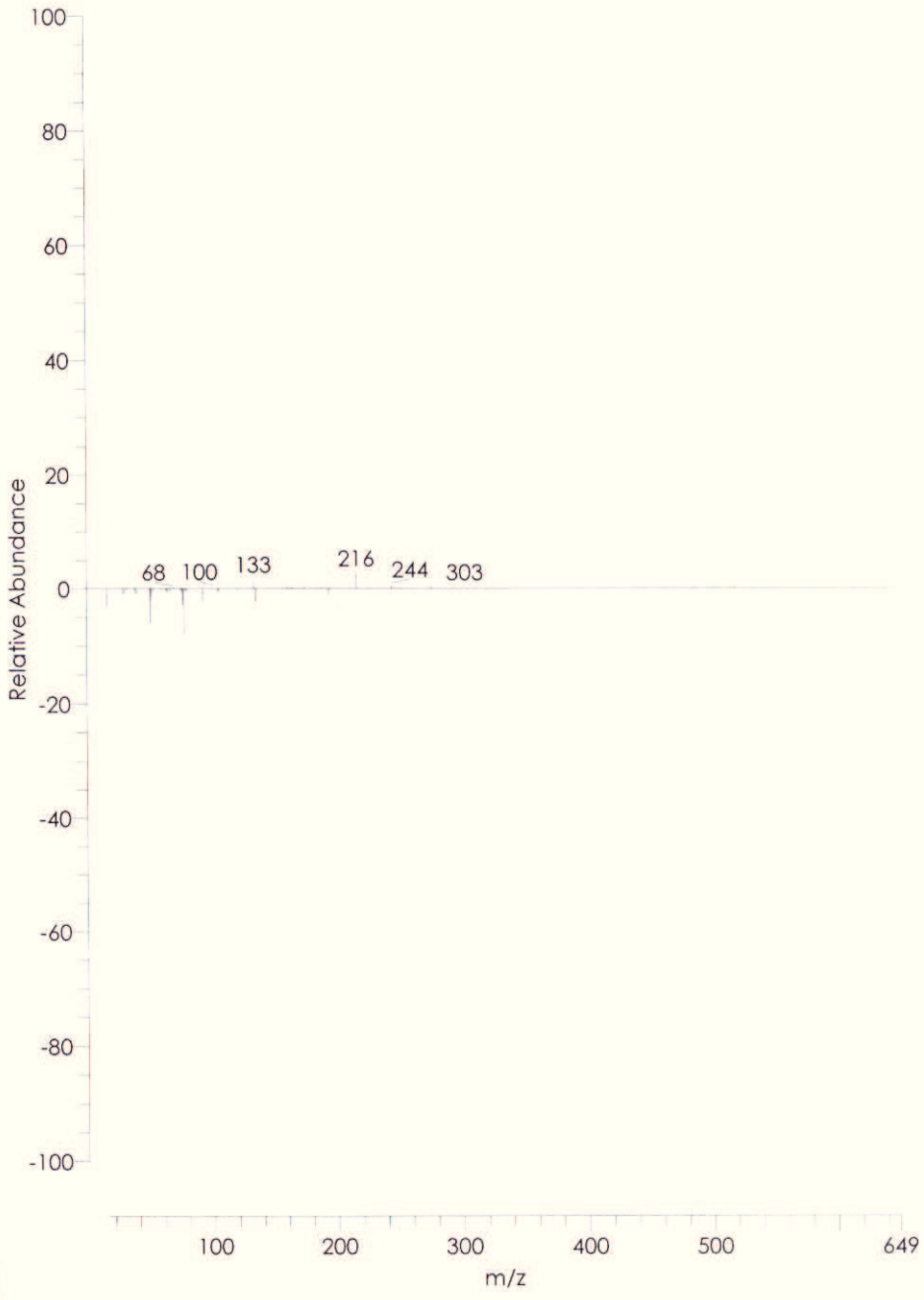

Hit	SI	RSI	Prob	Name
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3	749	803	88.01	Tetracosanoic c
4	749	803	88.01	Tetracosanoic c
5	746	792	88.01	Tetracosanoic c
6	693	748	7.68	Heneicosanoic
7	693	748	7.68	Heneicosanoic
8	628	708	1.23	Heptacosanoic
9	625	685	1.09	Octadecanoic
10	625	685	1.09	Octadecanoic
11	601	807	0.36	Heneicosanoic
12	601	740	0.36	Heneicosanoic
13	601	740	0.36	Heneicosanoic
14	595	648	0.28	Tricosanoic acic
15	594	631	0.27	Pentacosanoic
16	594	631	0.27	Pentacosanoic
17	590	622	0.23	Octacosanoic c
18	579	782	0.16	Eicosanoic acic

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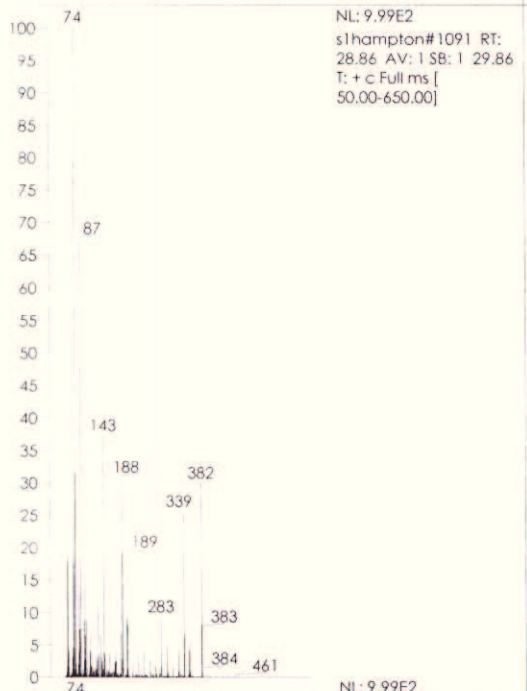

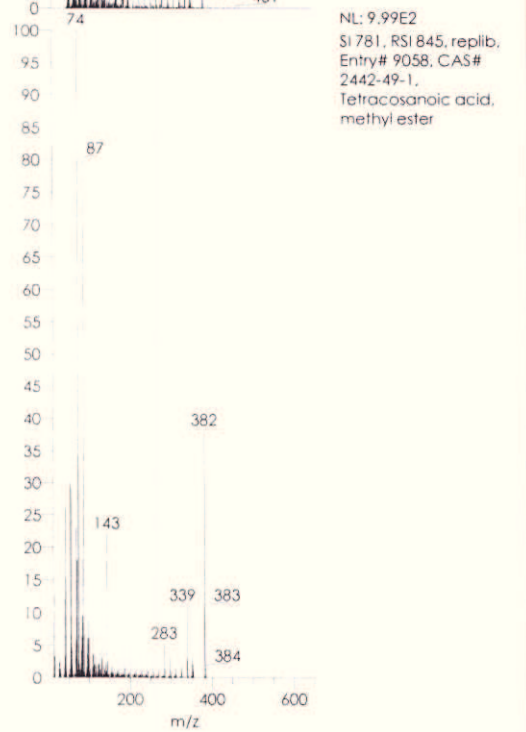

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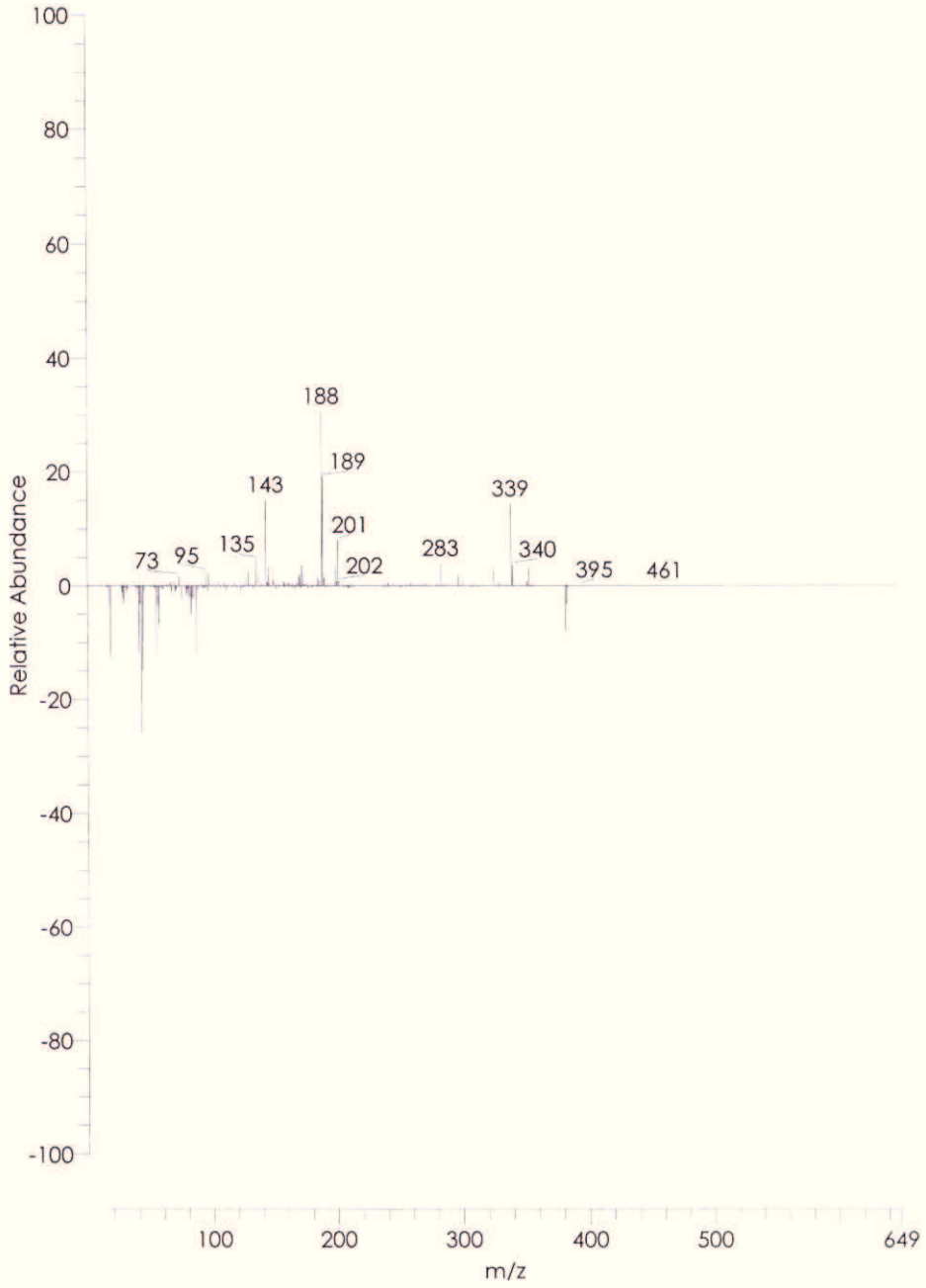

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2	701	812	63.74	Docosanoic ac
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4	699	856	63.74	Docosanoic ac
5	692	835	63.74	Docosanoic ac
6	677	935	63.74	Docosanoic ac
7	673	850	63.74	Docosanoic ac
8	597	805	63.74	Docosanoic ac
9	589	736	3.72	Tricosanoic acic
10	589	736	3.72	Tricosanoic acic
11	589	728	3.72	Octadecanoic
12	589	728	3.72	Octadecanoic
13	582	736	2.85	Nonadecanoic
14	581	793	2.74	Octadecanoic
15	581	651	2.74	Hexadecanoic
16	581	651	2.74	Hexadecanoic
17	580	699	2.85	Nonadecanoic
18	580	731	2.63	Hexadecanoic

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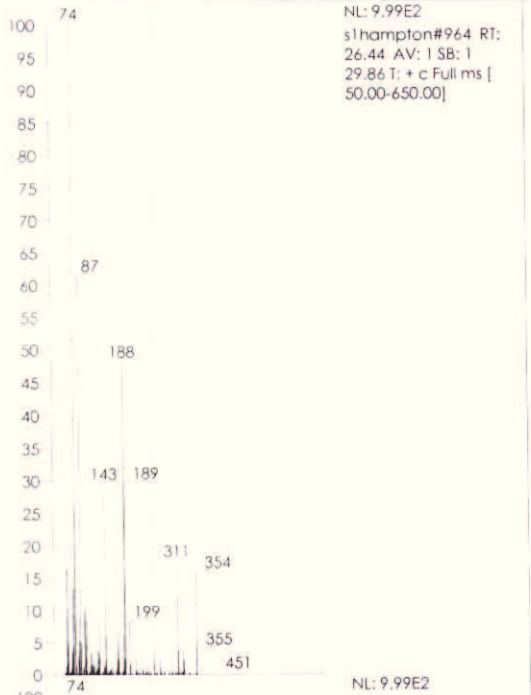

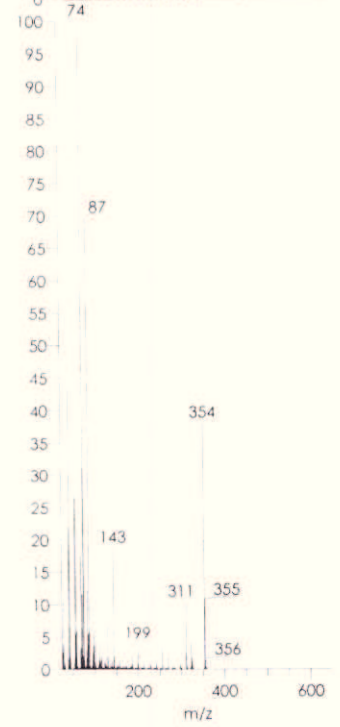

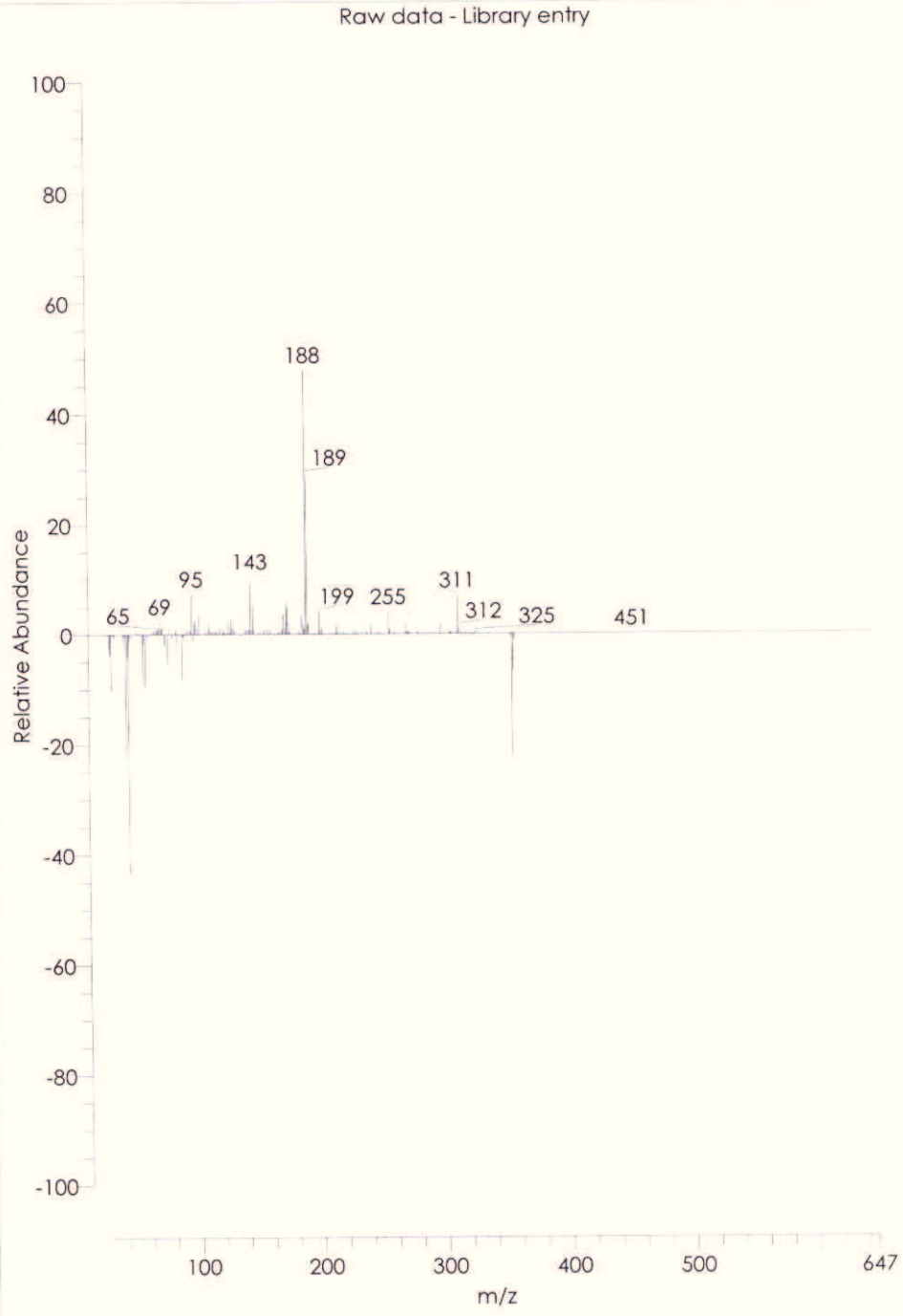

Conclusion

Sample 1, the Paint from Hampton Court contains either partially heat bodied linseed oil or possibly a modern alkyd paint based on linseed oil and phthalic anhydride and terephthalic acid, or both in different layers.

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4. Michael R Schilling and Herant P. Khanjian, "Gas Chromatographic determination of the Fatty acid and Glycerol Content of drying Oils part 1.", *ICOM Committee for Conservation, 11th triennial meeting, Edinburgh, 1996, Pre-prints,* **Volume 1**, James and James, London, 1996, p222.
5. John S. Mills and Raymond White, "Organic Mass spectrometry of art materials: work in progress", *The National Gallery Technical Bulletin*, **Volume 6** (1982). 3-18.

APPENDIX III LITHOLOGICAL SURVEY AND RECORDING

Lithological survey report by Robin Sanderson

The attached report was commissioned by Historic Royal Palaces prior to the repair works to the gatehouse and is included for reference purposes.

Record of removed stonework by Alison Kelly (Oxford Archaeology)

Stonework identified by the Project Architect for replacement was recorded prior to its removal. The attached list is a record of the stonework removed during the works.

LITHOLOGICAL SURVEY OF THE

BASE COURT (East) & CLOCK COURT (West) ELEVATIONS,

HAMPTON COURT PALACE.

R. W. Sanderson, B.Sc., C.Geol., F.G.S.

4th September 2008

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LITHOLOGICAL SURVEY OF THE BASE COURT (East) & CLOCK COURT (West) ELEVATIONS,

HAMPTON COURT PALACE.

R. W. Sanderson, B.Sc., C.Geol., F.G.S. 4th September 2008

Introduction:

This report was requested by Ms Patricia Leš, who requested the identification of the stone types and their possible sources. The elevations are shown in figs 1 &2, and Plates 1 & 2, below. Details are marked on the photogrammetric plots listed below.

Base Court, eastern side. HCP/BCT/516 to HCP/BCT/525 inclusive.

Clock Court, western side. HPclock01 to HPclock08 inclusive.

Clock Tower upstanding part. HCPclock09 and HCPclock10.

Parapets. HCPclock22 to HCPclock25, HCPclock27 to HCPclock30, EparaWF13, sheets 11, 13, 14, 15.

Identifications were effected by *in-situ* examination prior to maintenance and repair works. No samples were removed for further analysis. Much of the stonework is thickly patinated and in a number of instances stone identification is tentative or has not been possible. This dense brown and varnish-like patination is most intense on Bath stones and Wheatley Limestone (see Plates 3 & 8) and may result from dressing with boiled linseed oil to help blend 19th century repairs with old dirtied stone, as happened in the Master Carpenters' Court (Thurley, 2003. p.302). Apart from some admixture of Yorkstone in modern brickwork, stone masonry is restricted to the dressings of the parapets' coping, string courses, windows and door surrounds. Thirteen lithological types were noted, all but two being of English origin. These are, with CAD plot identifiers in brackets, as follows -

1. Bath Stones (B) Combe Down Oolite and Stoke Ground Base Bed.
2. Beer stone (Be)
3. Caen Stone (C)
4. Clipsham Stone. (LC)
5. Guiting stone (G)
6. Portland stone (P)
7. Reigate stone (R)
8. Weldon Stone (LW)
9. Wheatley Limestone (W)
10. Yorkstone (Y).
11. Unidentified limestones (U)
12. Granite.

The brick typology surveys by Daphne Ford (1991) (Figs 1 & 2) give useful information for dating the stone features. Most of the brick structure dates from the times of Cardinal Wolsey and King Henry VIII, with later 17th century additions and modern reconstruction of the parapets and chimneys.

Identification of the Stones.

1. Beer stone.

Near white crumbling limestone form the lintels of two second floor windows of the Clock Court northern section. The jambs and sill have been replaced by Bath stone (Plate 4). This is identified as Beer stone, a coarse shell detritus variety of Chalk (White Chalk Subgroup, Holywell Nodular Chalk Formation) from South Devon. It forms a lenticular stratum of restricted extent between Beer on the coast, and Wilmington, some 10km inland. Beer stone has been exploited since the 11th century for local use, and exported to London since at least the 13th century (Masey, 1882, Salzman, 1952). It does not well resist the weather, and these two lintels are rare survivals of its exterior use in the London region. Sir Christopher Wren employed it as interior wall facing at St Paul's Cathedral during the later part of the 17th century, a time agreeing with the presumed pre 1674 date for the windows.

2. Bath Stones. (Middle Jurassic. Great Oolite Group limestones)

More or less shelly matrix prominent oolitic limestones, sometimes showing fine lamination. These stones form new features, repairs and replacement dressings to the windows, doors, string courses and of the northern and southern sections of the Base Court elevation. They are unusually pale coloured where not showing densely patinated surfaces.

At least two variants may be distinguished, relating to different phases of repairs (Plate 3). Most probably derive from the Combe Down Oolite of the Great Oolite Group. At Hampton Court Palace it is probably all of 19th century date. The sills of some ground floor windows have been repaired by an unpatinated, more compact nodular type which is identified as from the Base Bed of the Stoke Hill quarry, Limpley Stoke (Stoke Ground Base Bed). This stone first came into production in 1982, previously having been considered too hard for economic hand working. It is recorded as having been used for repairs at Hampton Court completed in 1982 (Leary, 1983, p.19). Presumably the sills date from that time.

Bath Stone was not brought to London until the R. Avon was made navigable from Bath to Bristol in 1727. Little seems to have come to London until the early 19th century, after the opening of the Kennet-Avon canal in 1810. However it is recorded as having been used for repairs to Croydon Parish Church in 1763 (Parish of Croydon Trustees) and many of the early/mid 18th century garden ornaments at Lord Burlington's Chiswick House may also be of Bath Stone.

Caen stone.

Pale cream coloured fine grained limestone from Caen, Normandy.

This stone was used for the more prestigious features, such as the arches of Anne Boleyn's gateway, the windows of the Clock Tower, and survives as remnants in some of the first floor windows of the southern part of the Base Court elevation (Plates 5, 8, 9). It was imported until the later 19th century, but here all seems to be original 16th century material.

The southernmost first floor window of the Base Court side is very unusual in that the exterior face is currently mostly composed of Portland stone, but with small remnants of Caen stone in structurally weak positions (Plate 9). This suggests that the Portland stone may only be a superficial exterior restoration or reconstruction.

Clipsham stone type. (Middle Jurassic, Upper Lincolnshire Limestone Formation)

Coarse grained rough weathering peloidal shelly limestones, identified as Clipsham Stone from the Middle Jurassic Inferior Oolite, Lincolnshire Limestone, near Grantham, Lincolnshire, is found used for all the parapet coping and also the

Clipsham Stone appears mostly to have been a mid 20th century introduction to the London area. It does not figure in an authoritative 1923 account of the building stones of London (Elsden & Howe). It is here a common stone in the reconstructed parapets of the turrets (but not the NE & SE turrets of the Clock Tower, which are of Bath stone), and the accommodation ranges.

However, similar stone is present, mixed with Ketton Stone (another of the Lincolnshire Limestones) in the parapets' and chimney stacks' dressings of the Bloody and Wakefield Towers, HM Tower of London (Sanderson, 2004, 2006). These occurrences appear to be continuations of the 1886 rebuilding campaign of the Lanthorn Tower and the connecting South Inner Curtain, where the dressings seem to be all of Ketton Stone (these areas have yet to be surveyed in detail)

Granite.

Two bollards of grey coarse grained granite are situated, one on either side of the Clock Court entrance to Anne Boleyn's Gateway. Granites began to come to London as paving setts during the later 18th century, with larger blocks and greater quantities arriving from the early 19th century. These bollards are of South-West English types, and most probably 19th century additions perhaps related in time to the repaving of the Base Court carriageway with granite setts (Sanderson, 2008).

Guiting stone. (Middle Jurassic, Inferior Oolite Formation)

A few pieces of pale yellow, shell poor oolitic limestones, are tentatively identified as Guiting stone from the north Cotswolds. It differs from the similar Bath stone, with which it is

associated, in colour and poorer preservation. It is seen in the dressings of the 4-flue Henrician chimney stack in Clock Court, and is also present as small indents in the Bath stone copings of the Clock Tower eastern turrets.

Portland stone. (Upper Jurassic, Portland Formation)

White even grained oolitic limestone from south Dorset.

It is most prominent as the frame to the Base Court clock (Plate 14), the parapet and window sills of the south side Clock Tower, and as door steps in the Clock Court. The latter are of the first half of the 19th century. The Base Court clock and dial, dating from 1799, was brought from St James's Palace and reinstated here in 1835. However a view of the Clock Tower dated 1826 (Thurley, 2003, p.18) shows a clock face of very similar design

Reigate Stone. (Lower Cretaceous Upper Greensand)

Pale green-grey fine grained glauconitic 'malmstone' from Surrey, is seen as poorly preserved remnants in the dressings of the much restored ground floor windows of the south range in both the Base and Clock Court elevations (Plate 3) and the Buttery entrance (Plate 11). A single piece is present in the jamb of a tall 1st floor window (second to the south of the Clock Tower). Reigate Stone was commonly used by both Cardinal Wolsey and King Henry VIII for ashlar and dressings at Hampton Court Palace, and possibly also by Lord Daubeney at an earlier date (see the blocked door? arches in the exterior recess at the east end of the Great Kitchens. Its use by Wren, in the fountain Court cloisters, probably reflects re-use of salvage from the end 17th century demolition of the Tudor Palace.

Weldon stone. type. (Middle Jurassic, Inferior Oolite, Lincolnshire Limestone Formation).

Grey weathering, grain prominent oolitic limestone with little intergranular cement. Abraded and micritised shell fragments are scattered throughout. The structure is macroporous.

This lithology is typical of the area around Weldon in northern Northamptonshire, where it has long been quarried. It has a very good reputation for weather resistance, and it is surprising that few other undisputed uses of this stone in the Thames Valley are known to the writer. It is recorded as having been used by the architect J. L. Pearson for major restorations at Rochester Cathedral during 1889-95 (Worssam, 2001). During the present survey it has been found as pieced-in repairs, and more significantly as the corbels to the cantilevered small "modern" chimney adjacent to the north-west turret of the Clock Tower.

Elsewhere at Hampton Court it is to be found in the Tiltyard Tower parapet (Sanderson, 2006b) where it is concentrated in the crenellation copings, in association with shell-laminated Bath Stone, and as replacement of Wheatley Stone in the weathering course below the crenellations of the interior face of the parapet. A small quantity is also to be seen pieced-in in the string course.

Welsh Cambrian Slate.

The Base Court clock dial and superimposed monogrammed roundel are of grey weathering slate marked by ovoid paler greenish-grey reduction spots (Plates 14, 15). This lithology is typical of famous slates from the Cambrian System of North Wales.

The Base Court clock and dial, dating from 1799, was brought from St James's Palace and reinstated here in 1835. The clock face is formed of two horizontally butted pieces (Plate 14). This probably reflects transportation problems as slates of almost any dimensions could be extracted from the quarries. Good wagon roads from the quarries were almost non-existent in the 18th century North Wales, and most slate was transported by horse panniers.

Wheatley Limestone. (Middle Jurassic, Corallian Group, Wheatley Limestone)

A series of slightly variable, fine to medium grained, granular to flaky shell debris, porous grey-buff limestones formerly quarried at the adjacent parishes of Headington and Wheatley, now in the outskirts of Oxford. It is not possible to distinguish between the produce of these quarries, but the Headington quarries became more important after the 14th century (Arkell, 1947).

It has a poor reputation in Oxford, but is plentiful and often well preserved at Hampton Court where it occurs in the 1535 Moat Bridge parapet and the Tiltyard Tower parapet (Sanderson, 2006b). In the Base/Clock Courts elevations it is common in the jambs of Anne Boleyn's gateways (Plate 5), window surrounds (Plate 12) and string courses (Plate 13) which continue across the Caen stone gateway arches as hood mouldings. It seems to have been used several times, and in part replaces decayed Wolsey period Reigate stone window surrounds (Plate 3), but the associations are rather ambiguous. It all seems to be of pre-19th century date – for example, the string courses commonly show replacement of decayed basal mouldings by Bath stone strips and original ground floor Reigate stone windows are much restored with Wheatley Limestone. Are the gateway jambs possibly post Wolsey/Henry VIII restorations? There is also a single block of Caen stone in the Clock Court string course. The Henrician Reigate stone doors to the Buttery have been restored with Bath stone. A late feature appears to be the worn later 18th century door in the north-west corner of the Clock Court.

The only later works using this stone near London, known to the writer, are Asgill House, Richmond on Thames and Danson House, Bexleyheath, Kent, both built by Sir Robert Taylor in the 1760's.

"Yorkstone".

A number of brick-sized blocks of fine grained brown quartzose sandstone are randomly incorporated in the brick work of the 4-flue chimney stack of the south range, and similar stone forms a levelling? course at the rear base of the parapet by the southern turret of the Base Court

side. Similar, but laminated stone forms the sill to the window in the north side of the Clock Tower. These stones are of Coal Measures type from Yorkshire.

Unidentified stones.

The frame to the terracotts portrait roundel of Trajan is of an unidentified white even grained oolitic limestone. Apparently similar material is present as an indent to the northern 2nd floor window of the Buttery block.

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R.W. Sanderson

R.W. Sanderson

4th September 2008

Brick typology & dating by Daphne Ford, 1991.

A & B - pre 1528
C - 1529 - 66
E - Late 16th - early 17th century.
T - c. 19th century.

Subject sites of illustrations are numbered.

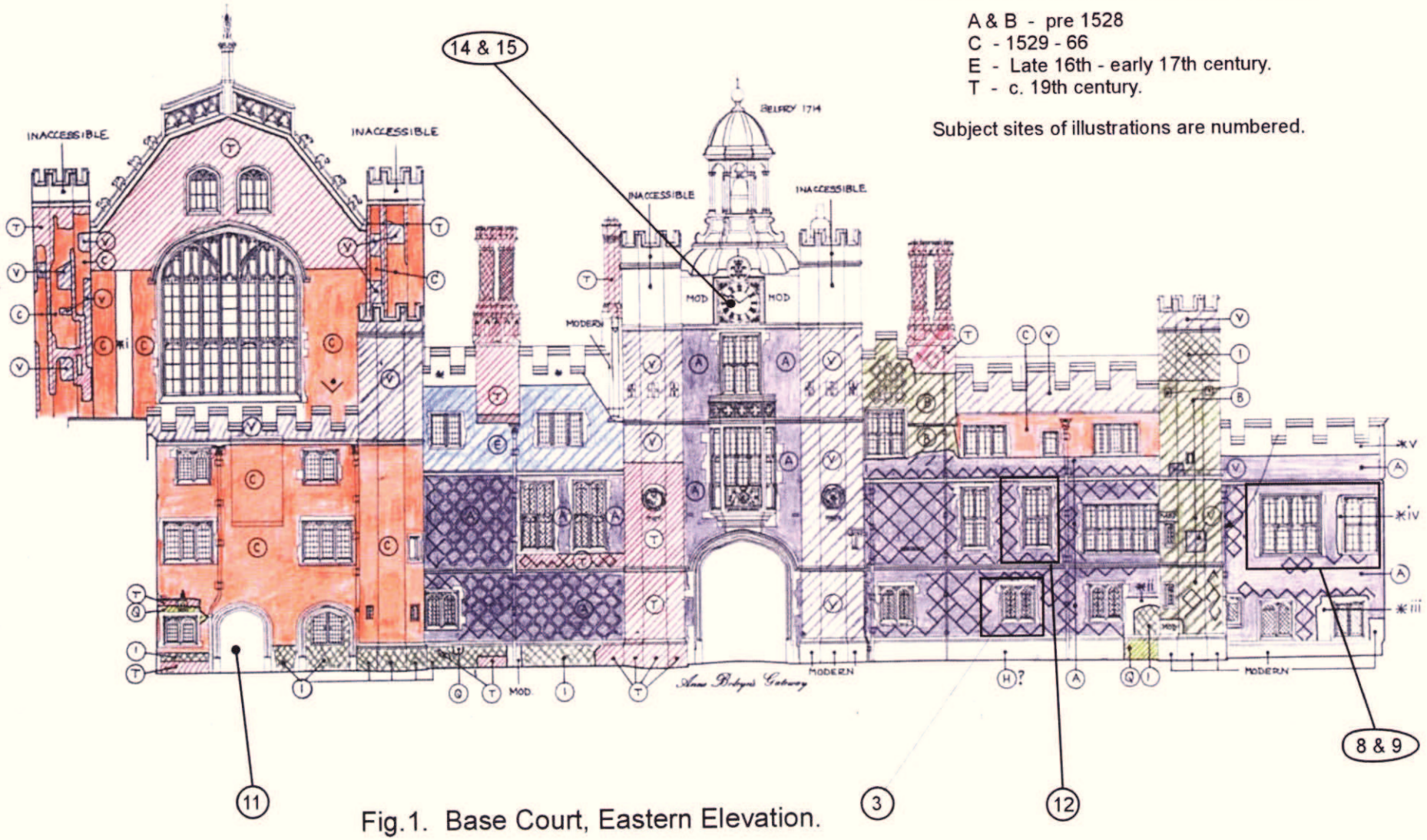


Fig.1. Base Court, Eastern Elevation.

Brick typology & dating by Daphne Ford, 1991.

A & B - pre 1528
C - 1529 - 66
E - Late 16th - early 17th century.
T - c. 19th century.

Subject sites of illustrations are numbered.

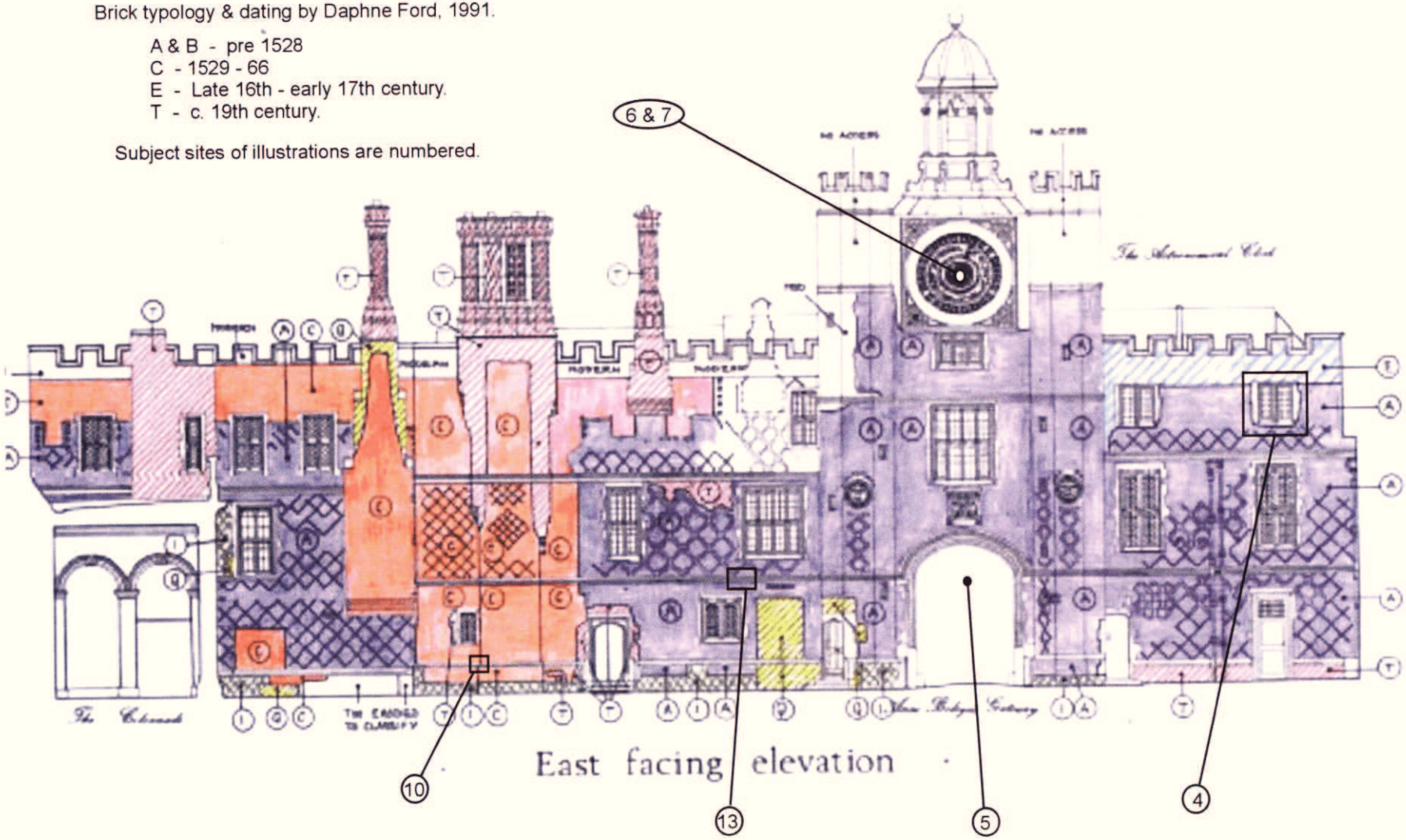


Fig. 2. Clock Court, Western elevation

Plate 1. Base Court, west facing elevation.

Plate 2. Clock Court, east facing elevation.

Plate 3. Base Court, ground floor window showing four phases of construction and repair. In order - Reigate stone (grey), Wheatley Limestone (grey-brown), Bath stone (brown), 20th century Bath Stoke Ground Base Bed (sill).

Plate 4. Clock Court, north-west corner 2nd floor window with Beer stone lintel & Bath stone jambs and sill.

Plate 5. Clock Tower, east entrance showing Caen stone arch and Wheatley Limestone jambs.

Plate 6. Astronomical Clock. Earlier dial of Caen stone normally hidden behind astronomical dial.

Plate 7. Detail of Plate 6. The yellow outer stone of the surround is a 20th century Clipsham stone restoration.

Plate 8. Base Court 1st floor windows at south end of range. Remnants of Caen stone (C) in jambs.

Plate 9. Detail of right hand window of Plate 8.

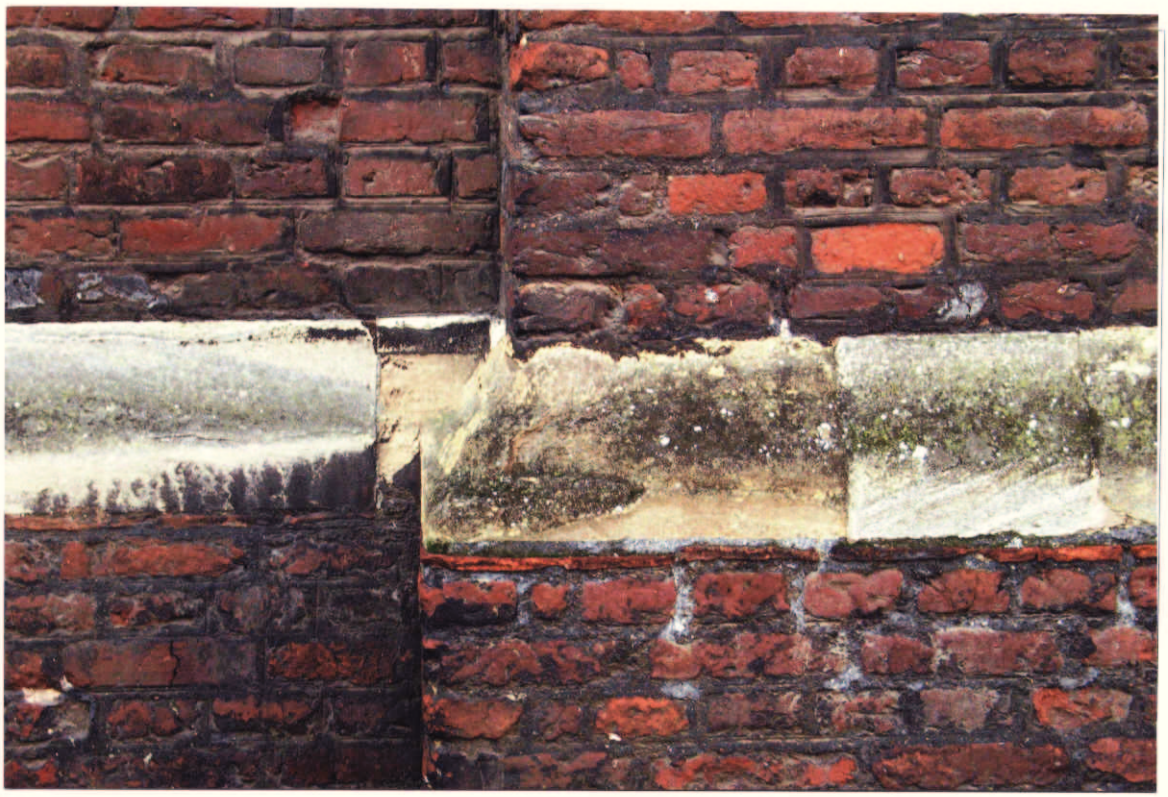


Plate 10. Clock court, 4-flue chimney stack plinth. Yellow Guiting stone? replacement in Bath stone offset course.

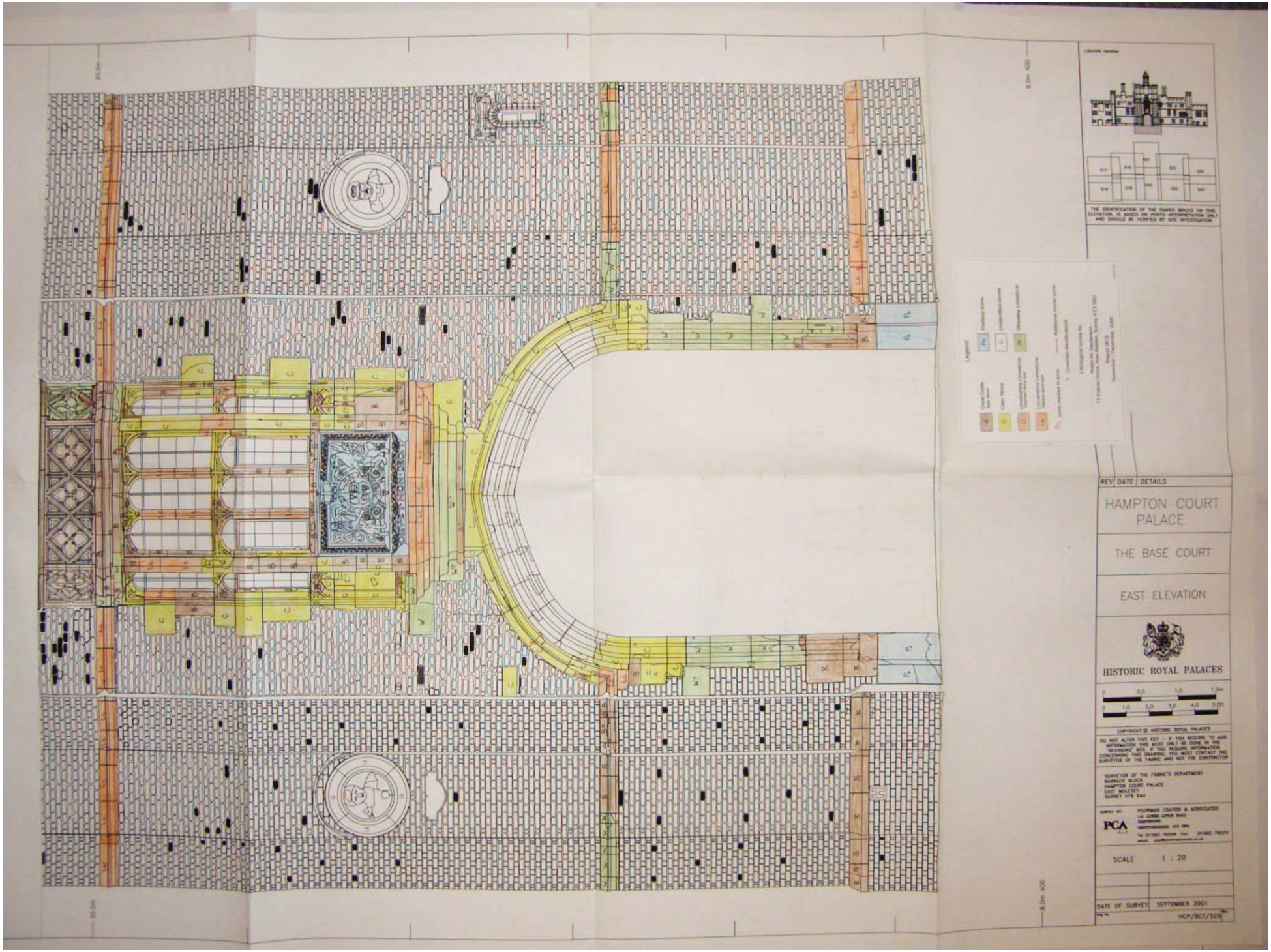
Plate 11. Base Court. Buttery door. Reigate stone survival in inner arch.

Plate 12. Base Court, south range. 1st floor window of Wheatley Limestone.

Plate 13. Clock Court. Tile levelling course below Wheatley Limestone string course.

Plate 14. Base Court clock dial. Welsh Cambrian slate.

Plate 15. Reduction spots in slate. Detail of Plate 14.


HAMPTON COURT PALACE
THE BASE COURT
EAST ELEVATION
HISTORIC ROYAL PALACES
SCALE 1 : 20
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HCP/BCT/S20
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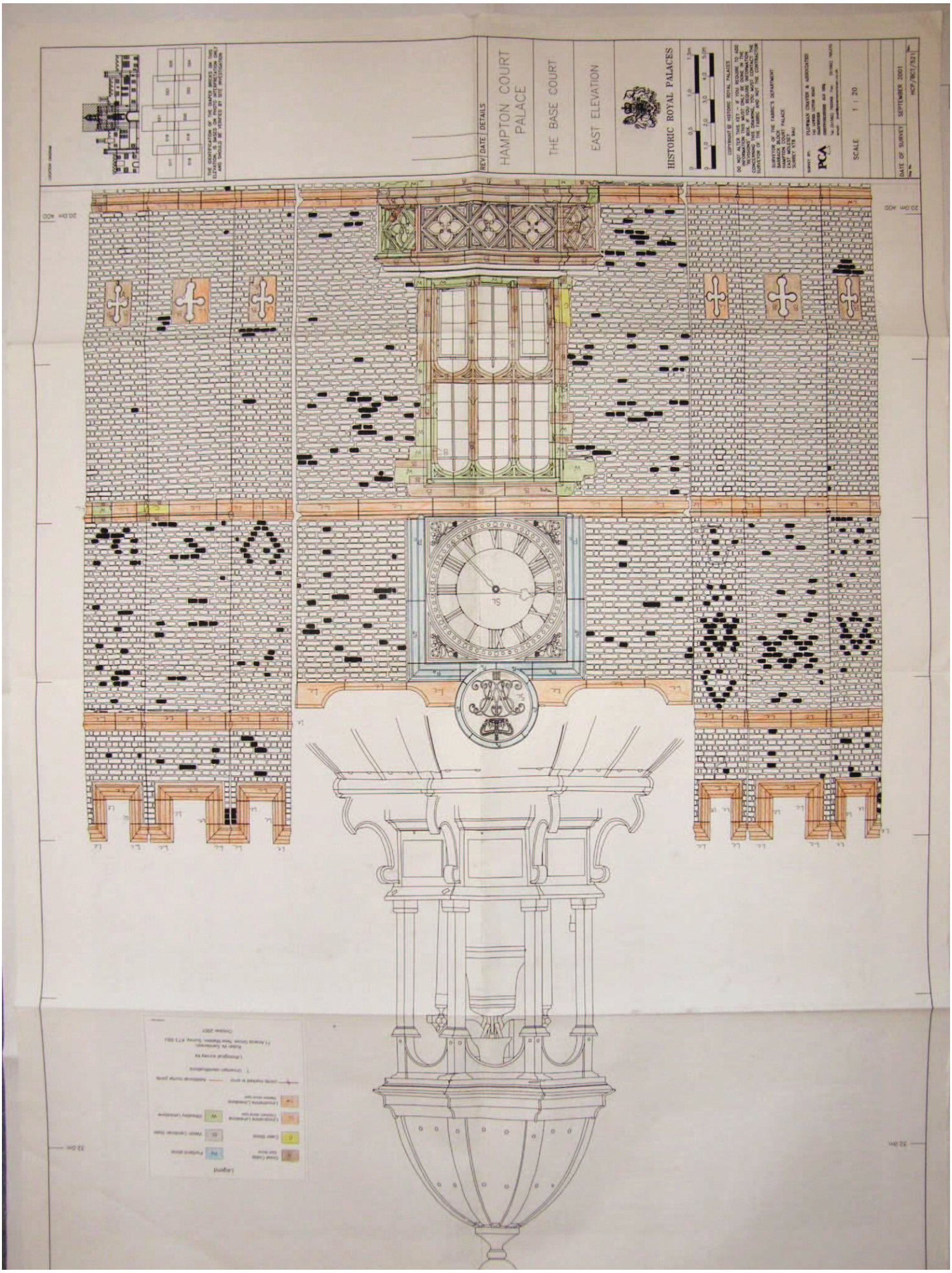
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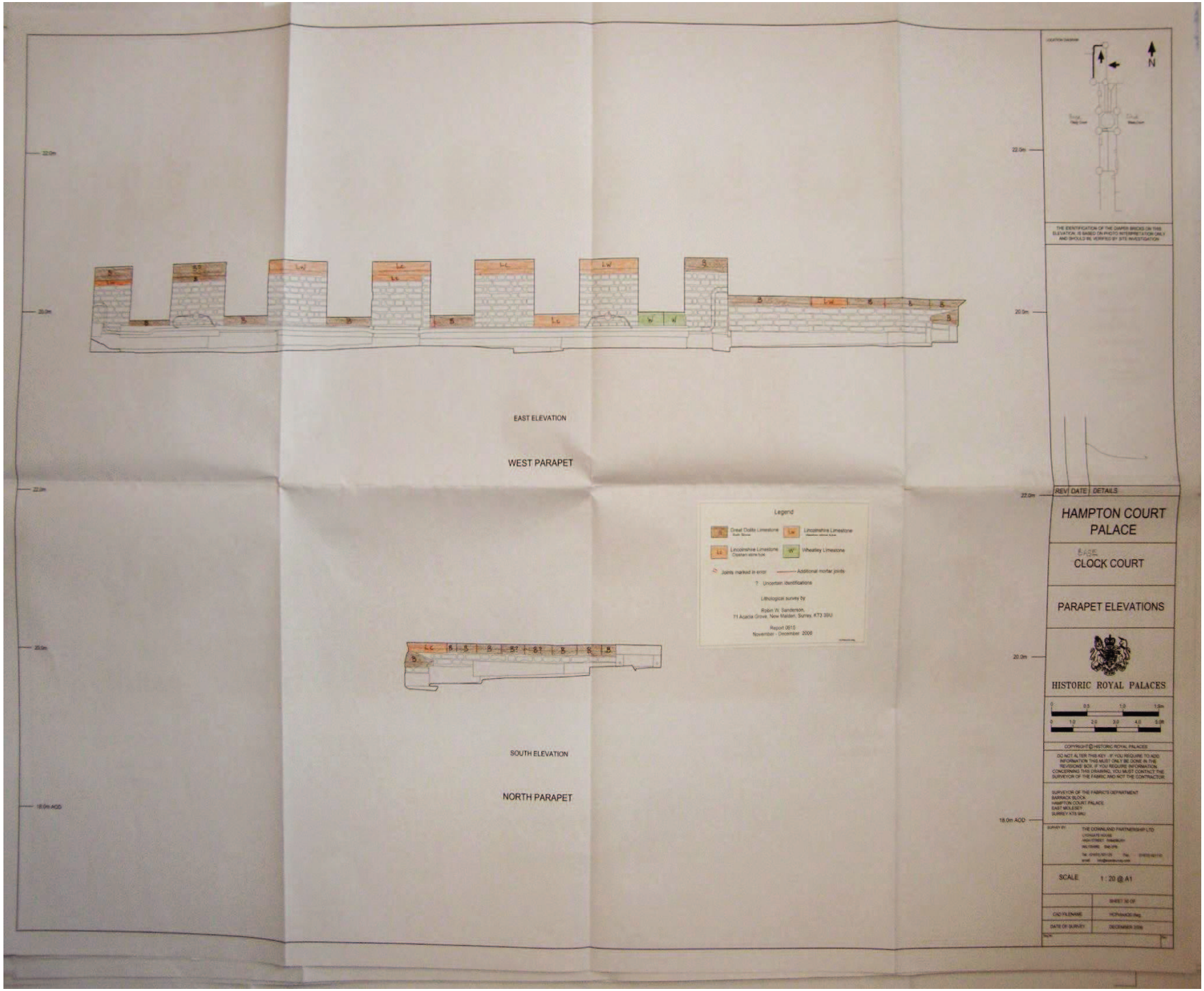
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Legend
Great Oolite Limestone
Lincolnshire Limestone
Lincolnshire Limestone
Wheatley Limestone
Joints marked in error
Additional mortar joints
? Uncertain identifications
Lithological survey by
Robin W. Sanderson,
71 Acacia Grove, New Malden, Surrey, KT3 3SU
Report 0615
November - December 2008
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HAMPTON COURT PALACE
BASE
CLOCK COURT
PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
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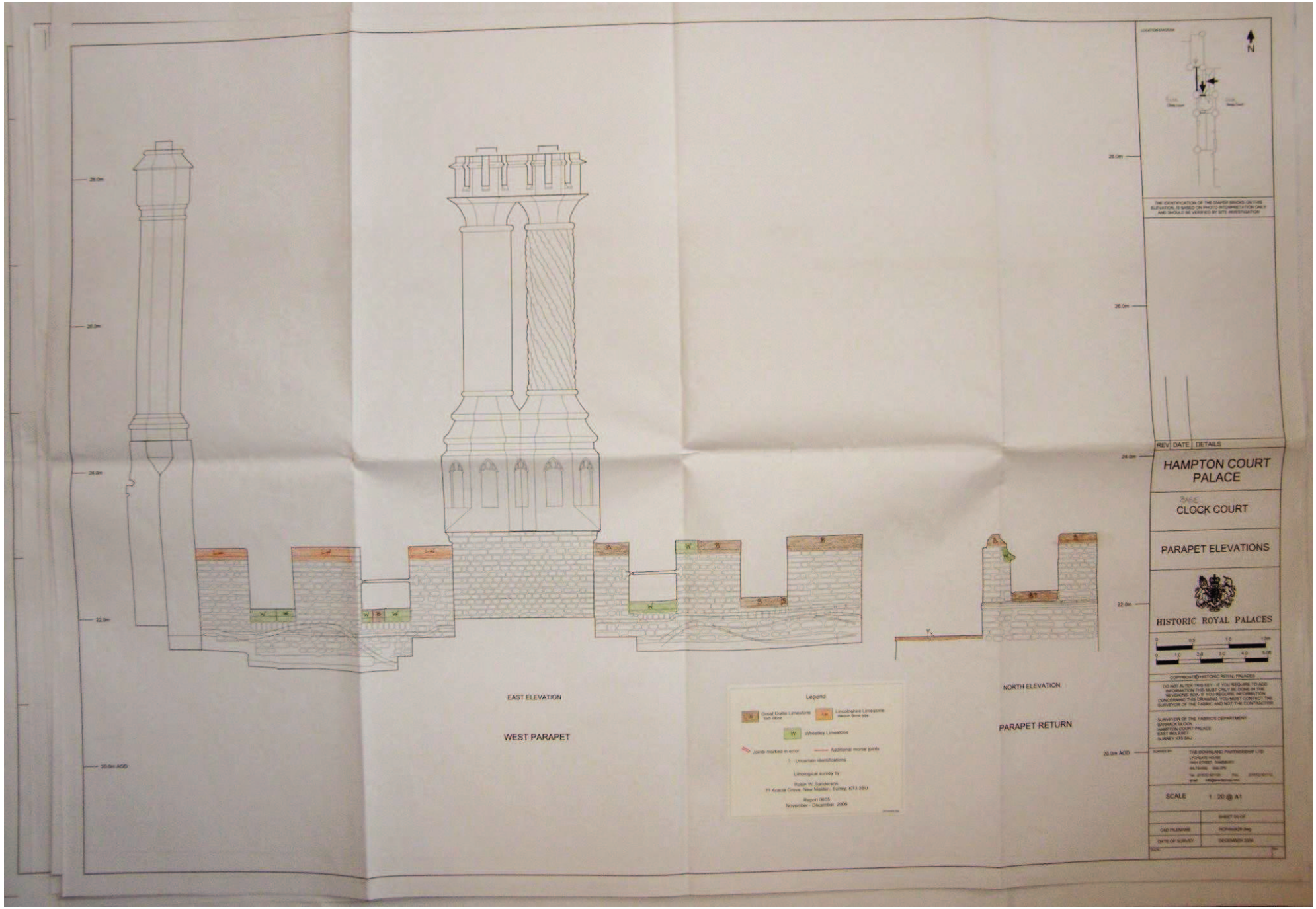
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WEST PARAPET
NORTH ELEVATION
PARAPET RETURN
Legend
Joints marked in error
Additional mortar joints
? Uncertain identifications
Lithological survey by
Robin W. Sanderson
11 Acacia Grove, New Malden, Surrey, KT3 3BU
Report 0815
November - December 2006
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CLOCK COURT
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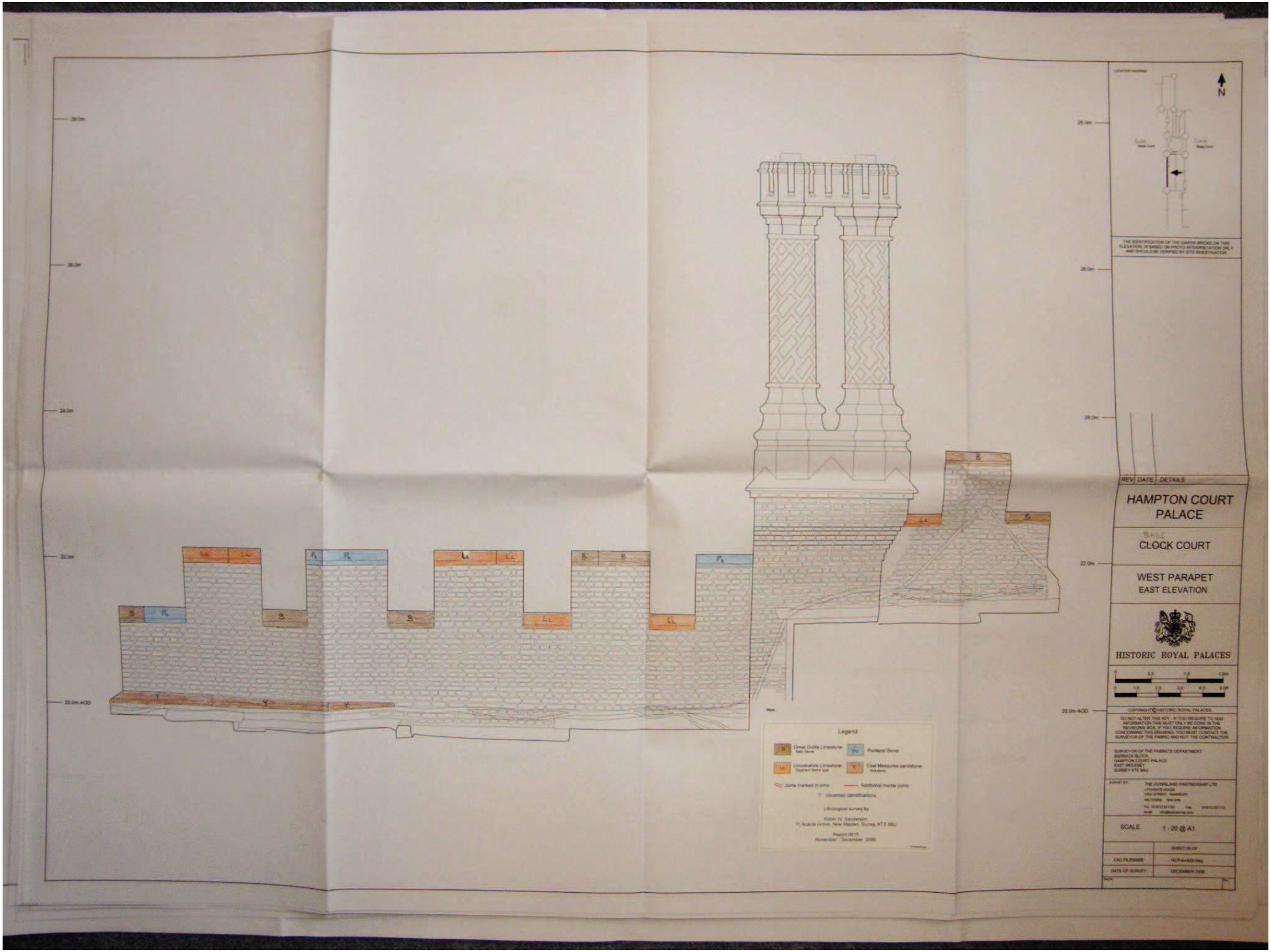
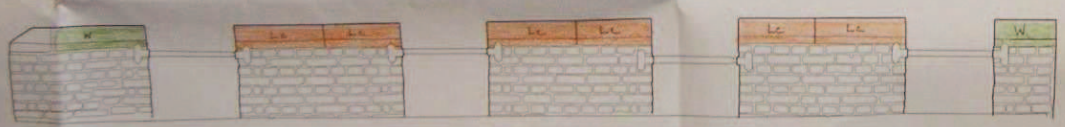
HISTORIC ROYAL PALACES
SCALE 1:20 @ A1


28.0m
26.0m
24.0m
22.0m
20.0m AOD
N
Legend
Great Oolite Limestone
Bath Stone
Portland Stone
Lincolnshire Limestone
Quarrington Stone type
Coal Measures sandstone
Yorkstone
Joints marked in error
Additional mortar joints
T Uncertain identifications
Lithological survey by
Robin W. Sanderson,
71 Acacia Grove, New Malden, Surrey, KT3 3RU
Report 0813
November - December 2006
REV DATE DETAILS
HAMPTON COURT PALACE
BASE
CLOCK COURT
WEST PARAPET
EAST ELEVATION
HISTORIC ROYAL PALACES
SCALE 1 : 20 @ A1



Legend

Lc Lincolnshire Limestone Clipsham stone type

W Wheatley Limestone

Joints marked in error

Additional mortar joints

? Uncertain identifications

Lithological survey by

Robin W. Sanderson
71 Acacia Grove, New Malden, Surrey, KT3 3BU

Report 0615
November - December 2006

LOCATION DIAGRAM

N

24.0m

22.0m

20.0m

18.0m

16.0m AOD

THE IDENTIFICATION OF THE DIAPER BRICKS ON THIS ELEVATION, IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION

REV	DATE	DETAILS

HAMPTON COURT PALACE

BASE
CLOCK COURT

WEST PARAPET
EAST ELEVATION

HISTORIC ROYAL PALACES

0 0.5 1.0 1.5m

0 1.0 2.0 3.0 4.0 5.0m

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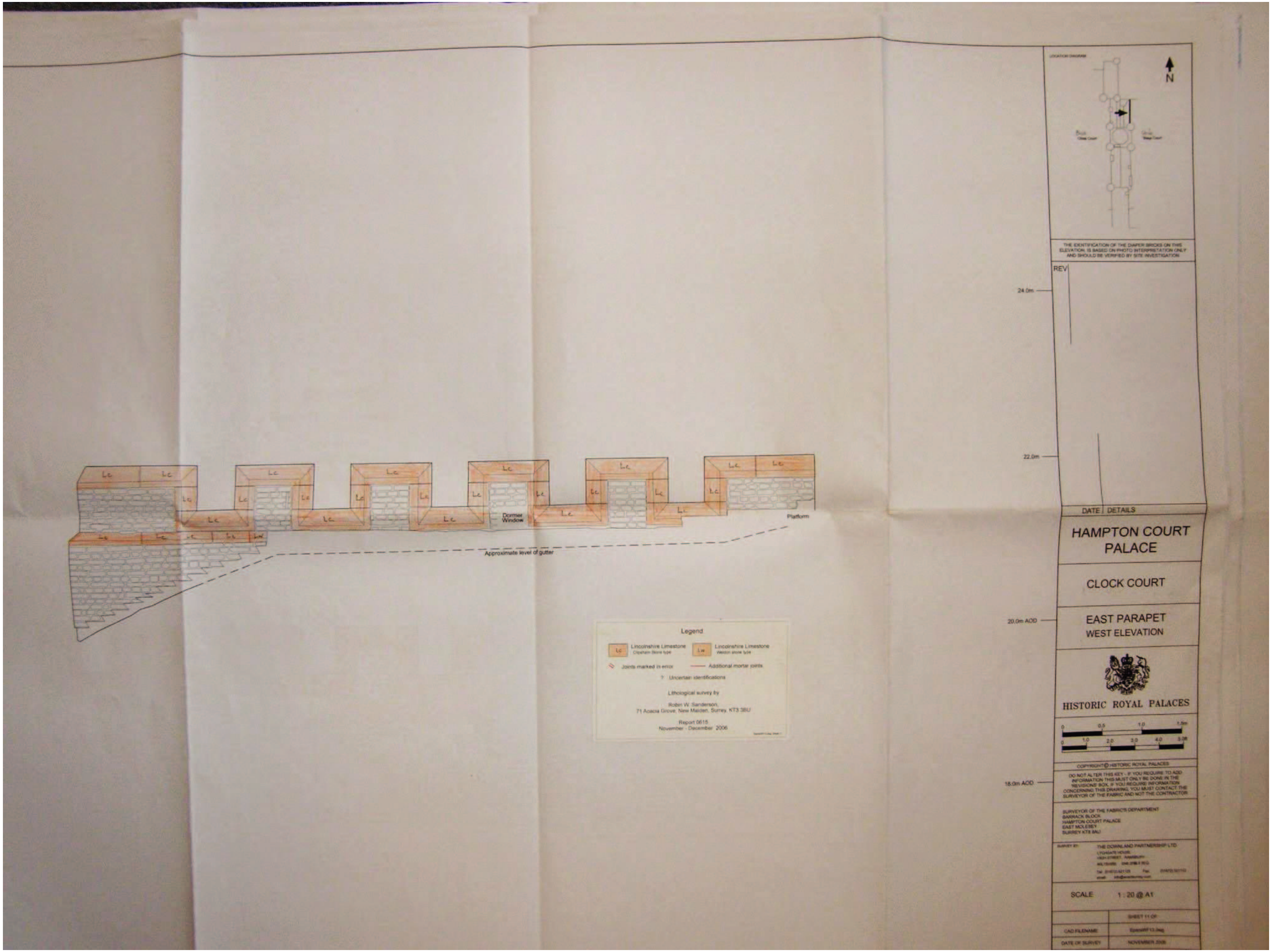
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU

SURVEY BY: THE DOWNLAND PARTNERSHIP LTD


N
THE IDENTIFICATION OF THE DIAPER BRICKS ON THIS ELEVATION IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION
REV
DATE
DETAILS
24.0m
22.0m
20.0m AOD
18.0m AOD
HAMPTON COURT PALACE
CLOCK COURT
EAST PARAPET
WEST ELEVATION
HISTORIC ROYAL PALACES
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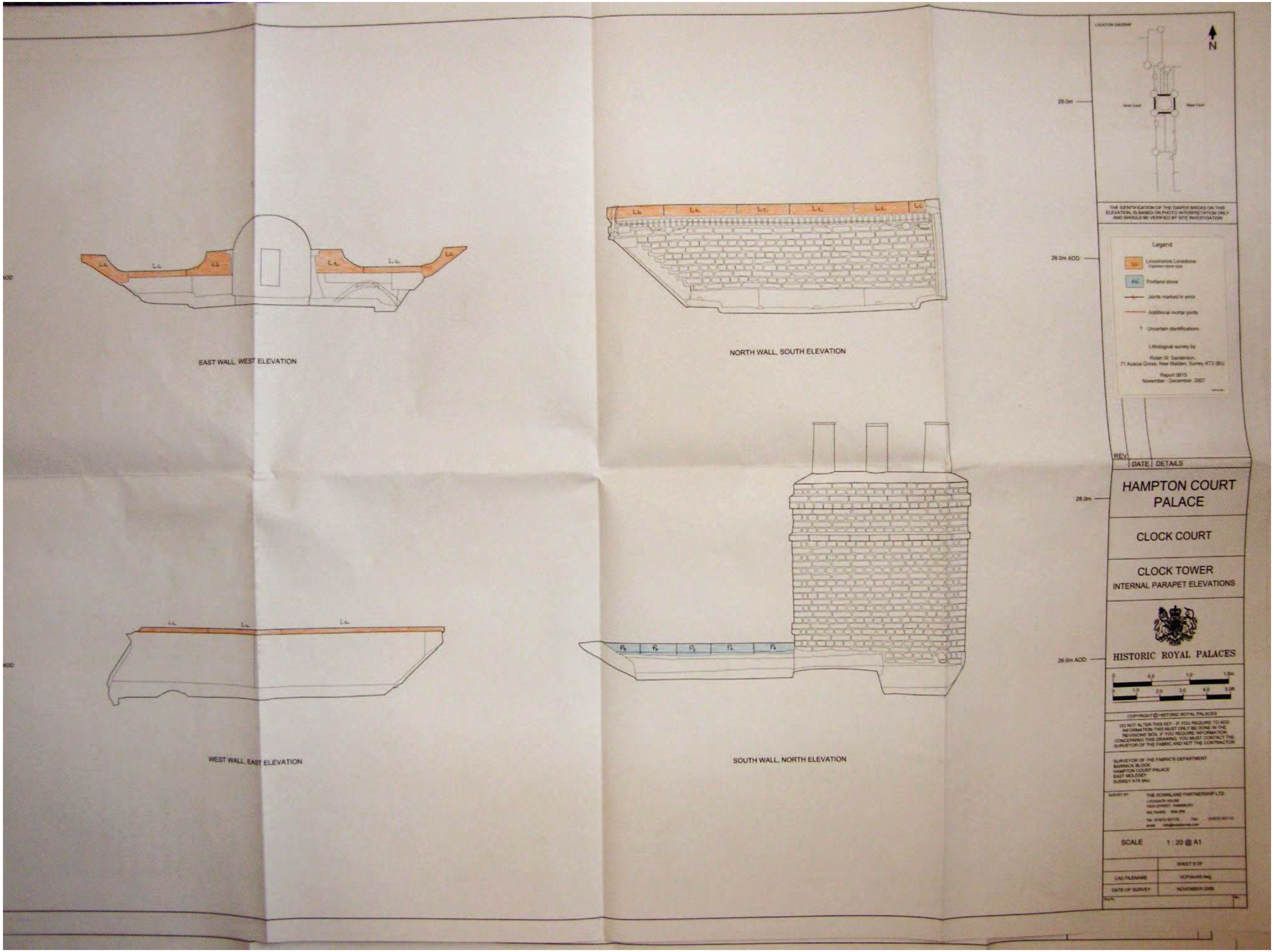
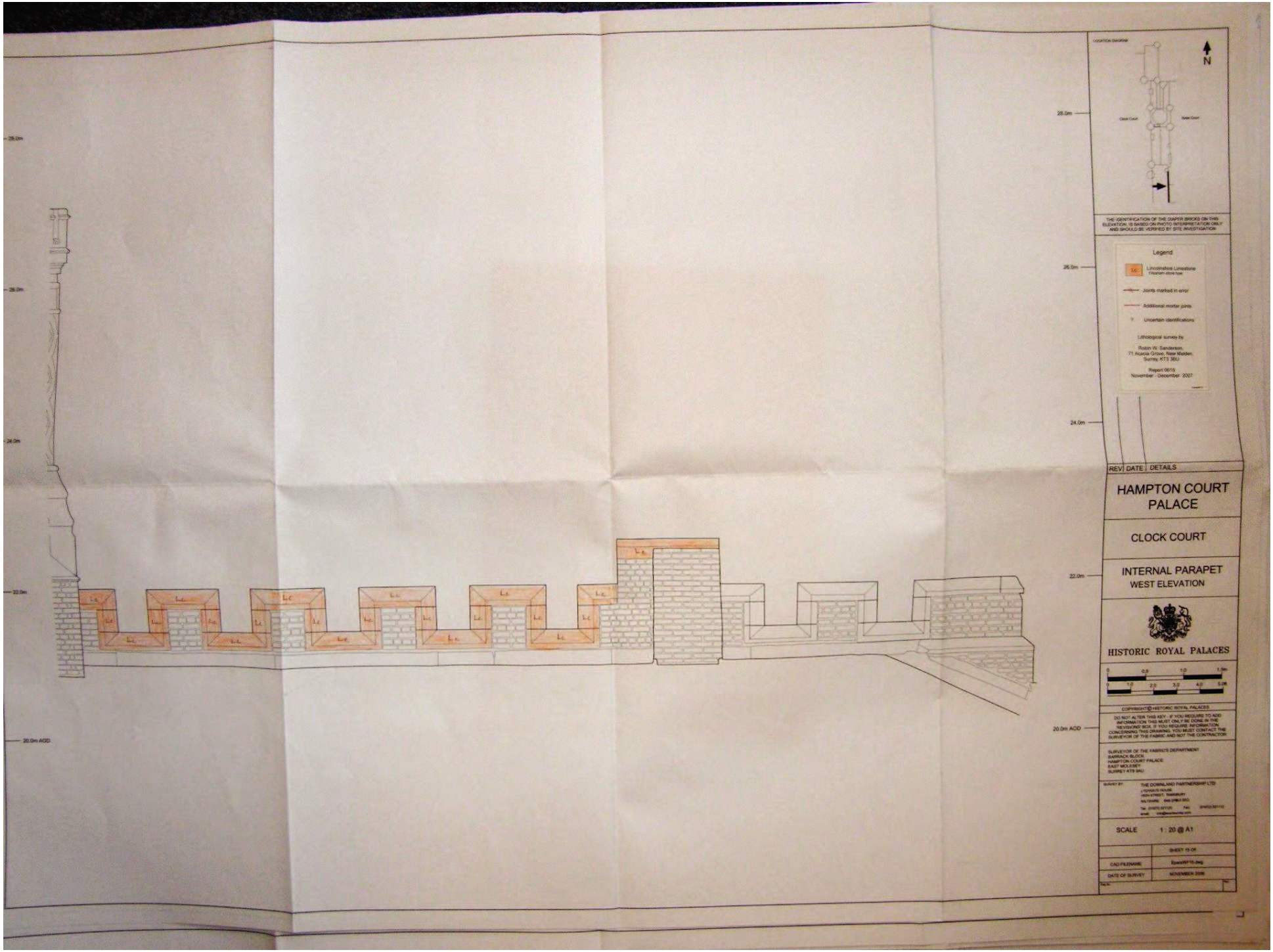
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
SURVEY BY
THE DOWNLAND PARTNERSHIP LTD
SCALE 1 : 20 @ A1
SHEET 11 OF
CAD FILENAME
DATE OF SURVEY
NOVEMBER 2006
Dormer Window
Platform
Approximate level of gutter
Legend
Lc Lincolnshire Limestone
Clipsham Stone type
Lw Lincolnshire Limestone
Weldon stone type
Joints marked in error
Additional mortar joints
? Uncertain identifications
Lithological survey by
Robin W. Sanderson,
71 Acacia Grove, New Malden, Surrey, KT3 3BU
Report 0615
November - December 2006



EAST WALL, WEST ELEVATION
NORTH WALL, SOUTH ELEVATION
WEST WALL, EAST ELEVATION
SOUTH WALL, NORTH ELEVATION
N
28.0m
28.0m AOD
26.0m AOD
THE IDENTIFICATION OF THE DIAPER BRICKS ON THIS ELEVATION, IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION
Legend
Lincolnshire Limestone
Portland stone
Joints marked in error
Additional mortar joints
? Uncertain identifications
Lithological survey by
Robin W. Sanderson,
71 Acacia Grove, New Malden, Surrey, KT3 3BU
Report 0615
November - December 2007
REV
DATE
DETAILS
HAMPTON COURT PALACE
CLOCK COURT
CLOCK TOWER
INTERNAL PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
COPYRIGHT © HISTORIC ROYAL PALACES
SCALE
1 : 20 @ A1
CAD FILENAME
DATE OF SURVEY


N
28.0m
26.0m
24.0m
22.0m
20.0m AOD
THE IDENTIFICATION OF THE DIAPER BRICKS ON THIS ELEVATION IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION
Legend
Lincolnshire Limestone
Clipsham stone type
Joints marked in error
Additional mortar joints
Uncertain identifications
Lithological survey by
Robin W. Sanderson,
71 Acacia Grove, New Malden,
Surrey, KT3 3BU
Report 0610
November - December 2007
REV DATE DETAILS
HAMPTON COURT PALACE
CLOCK COURT
INTERNAL PARAPET
WEST ELEVATION
HISTORIC ROYAL PALACES
0 0.5 1.0 1.5m
0 1.0 2.0 3.0 4.0 5.0ft
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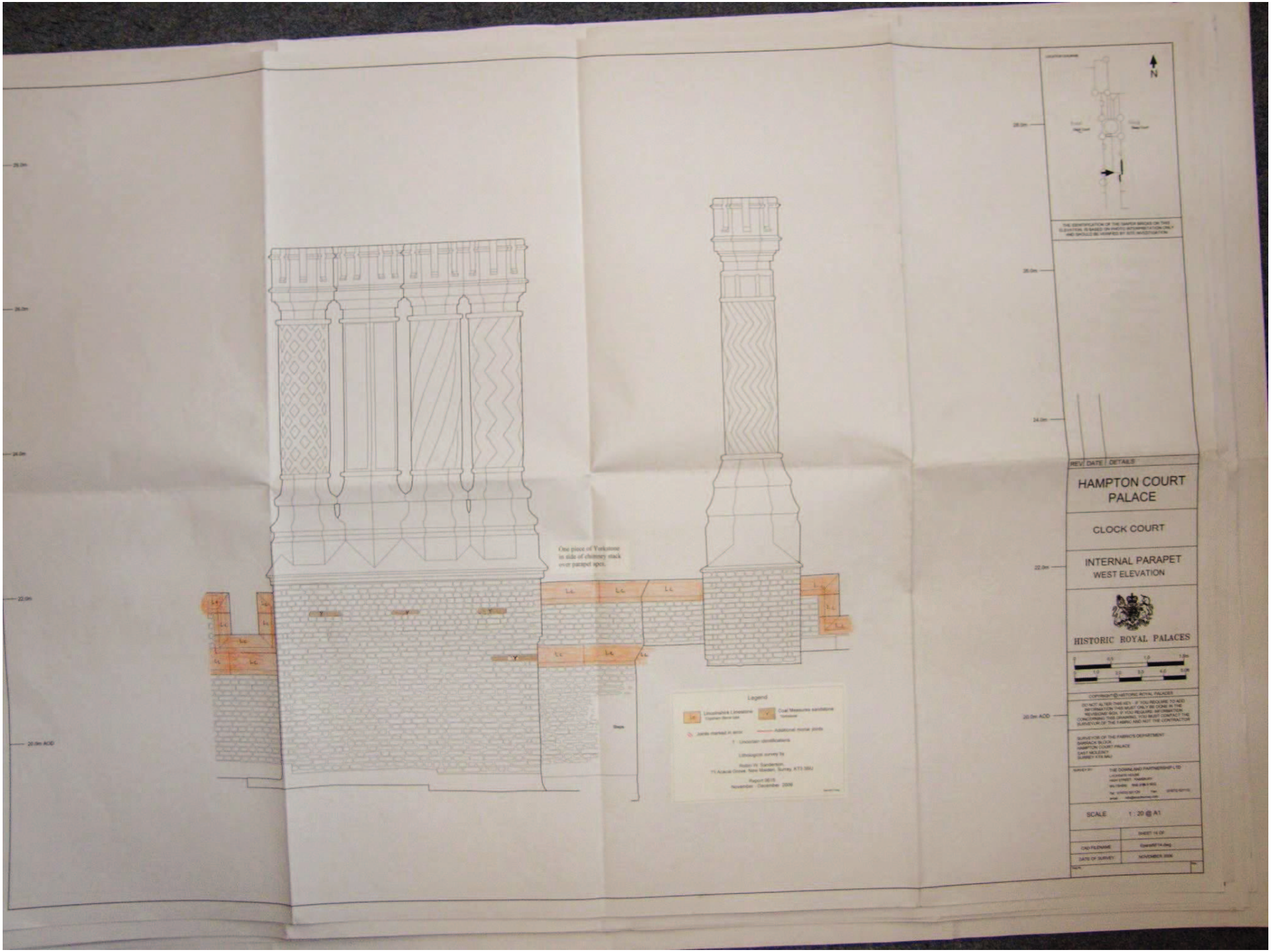
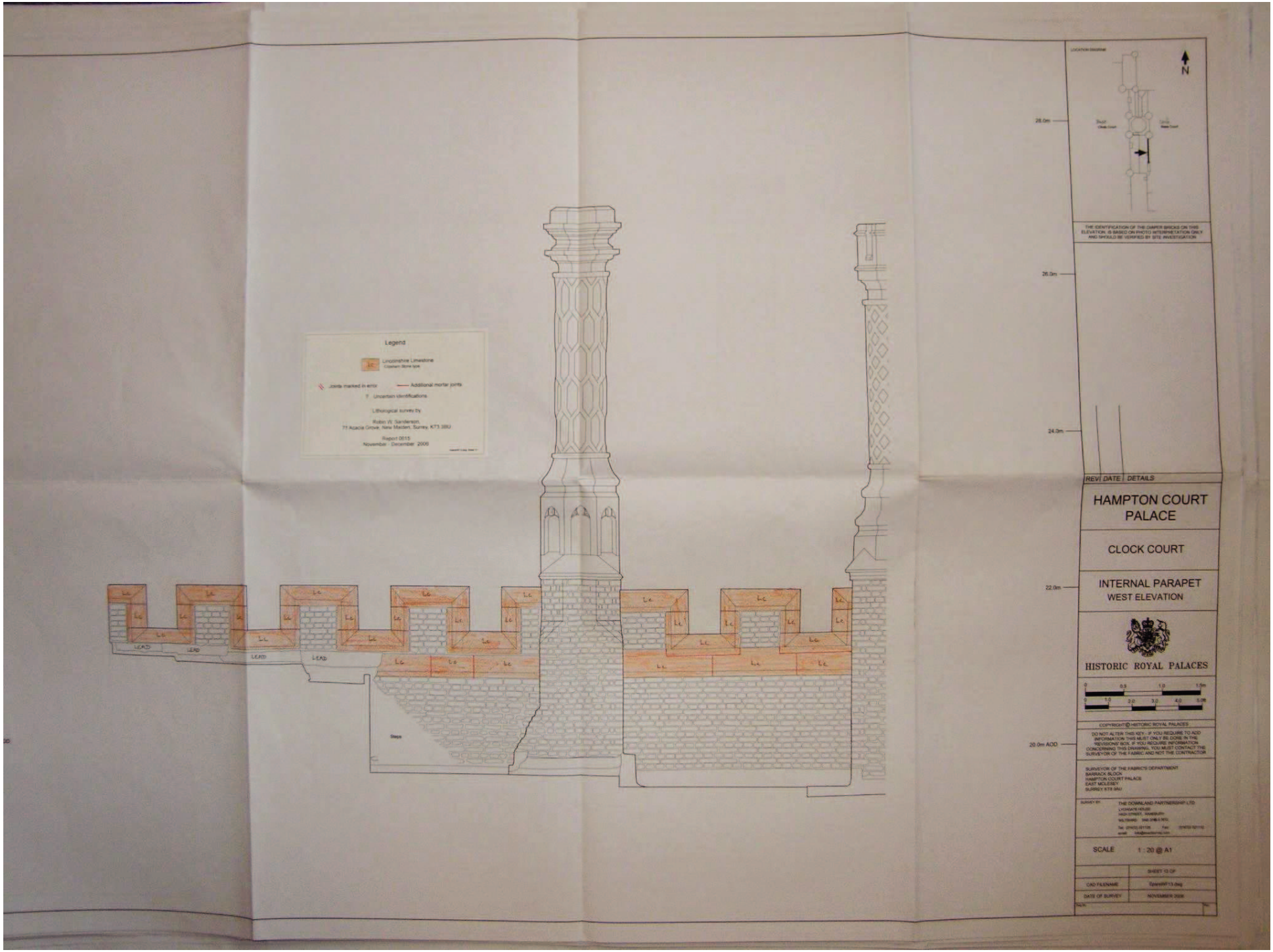
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
SURVEY BY:
THE DOWNLAND PARTNERSHIP LTD
SCALE 1 : 20 @ A1
SHEET 10 OF
CAD FILENAME
DATE OF SURVEY NOVEMBER 2008


N
One piece of Yorkstone in side of chimney stack over parapet spot.
Legend
HAMPTON COURT PALACE
CLOCK COURT
INTERNAL PARAPET
WEST ELEVATION
HISTORIC ROYAL PALACES
SCALE 1 : 20 @ A1
NOVEMBER 2008


Legend
Lincolnshire Limestone
Joints marked in error
Additional mortar joints
T Uncertain identifications
Lithological survey by
Robin W. Sanderson,
77 Acacia Grove, New Malden, Surrey, KT3 3RU
Report 0615
November - December 2006
LEAD
LEAD
LEAD
LEAD
Steps
28.0m
26.0m
24.0m
22.0m
20.0m AOD
N
THE IDENTIFICATION OF THE LIMPER BRICKS ON THIS ELEVATION, IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION
REV DATE DETAILS
HAMPTON COURT PALACE
CLOCK COURT
INTERNAL PARAPET
WEST ELEVATION
HISTORIC ROYAL PALACES
0 0.5 1.0 1.5m
0 1.0 2.0 3.0 4.0 5.0ft
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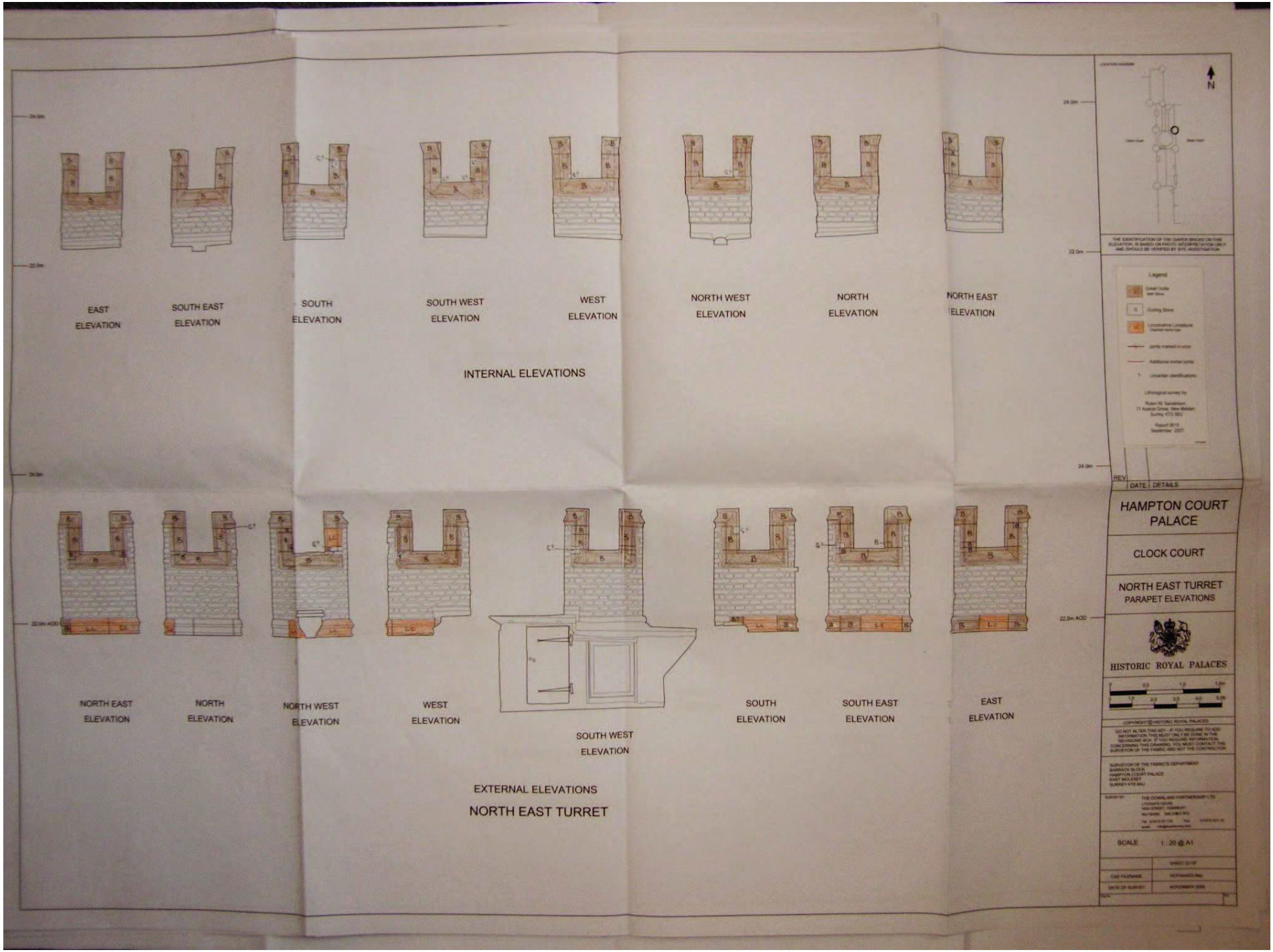
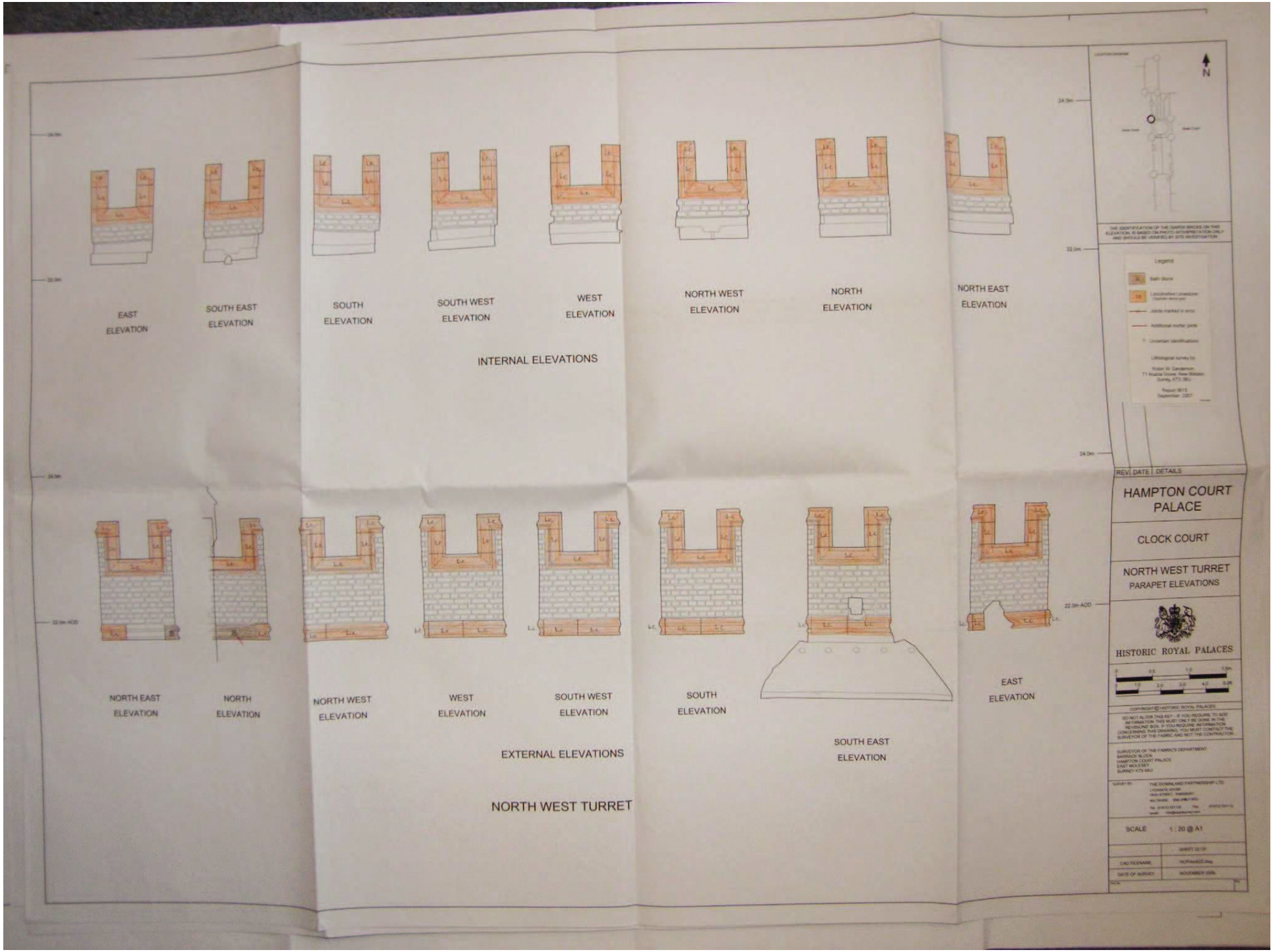
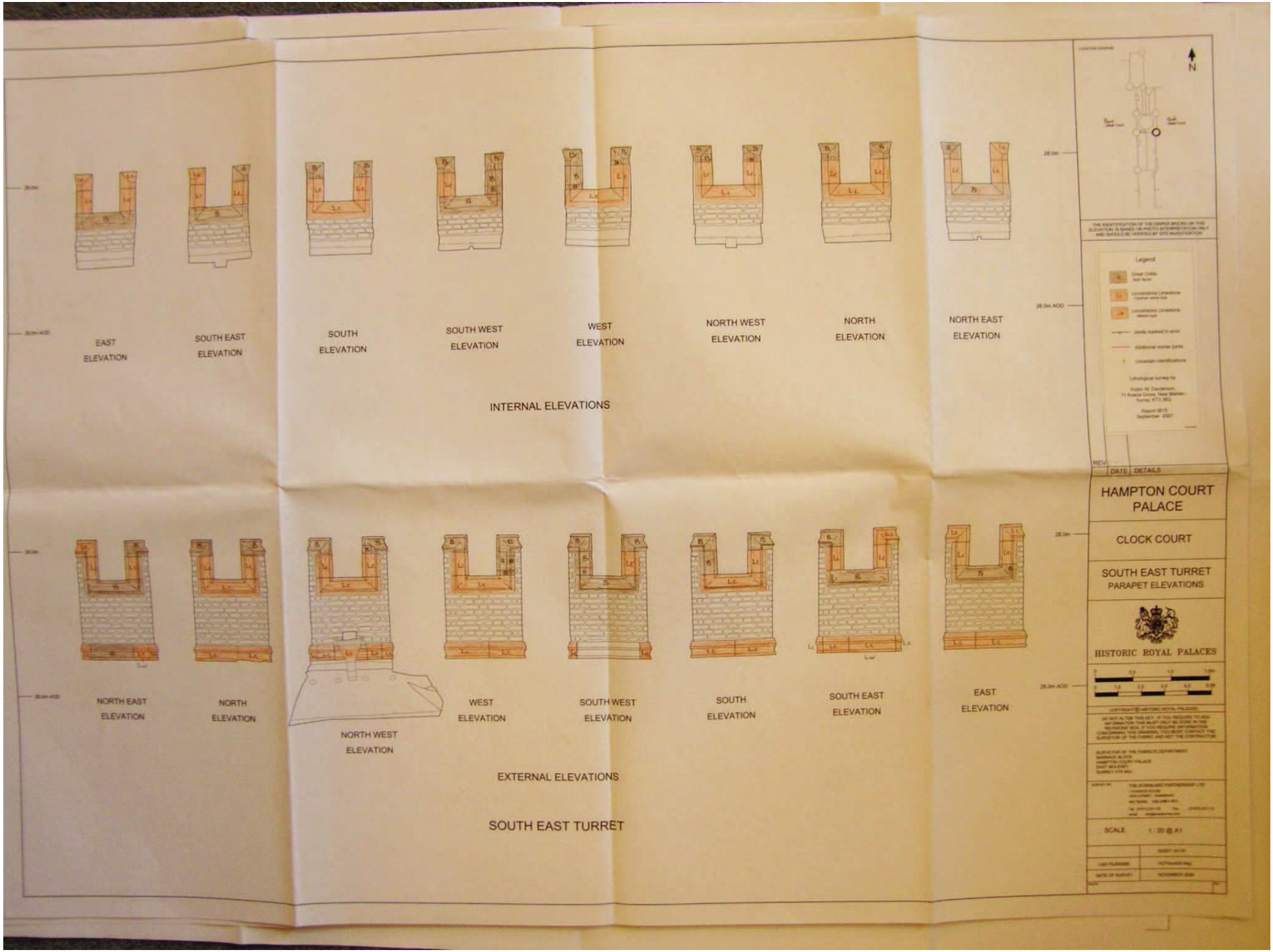
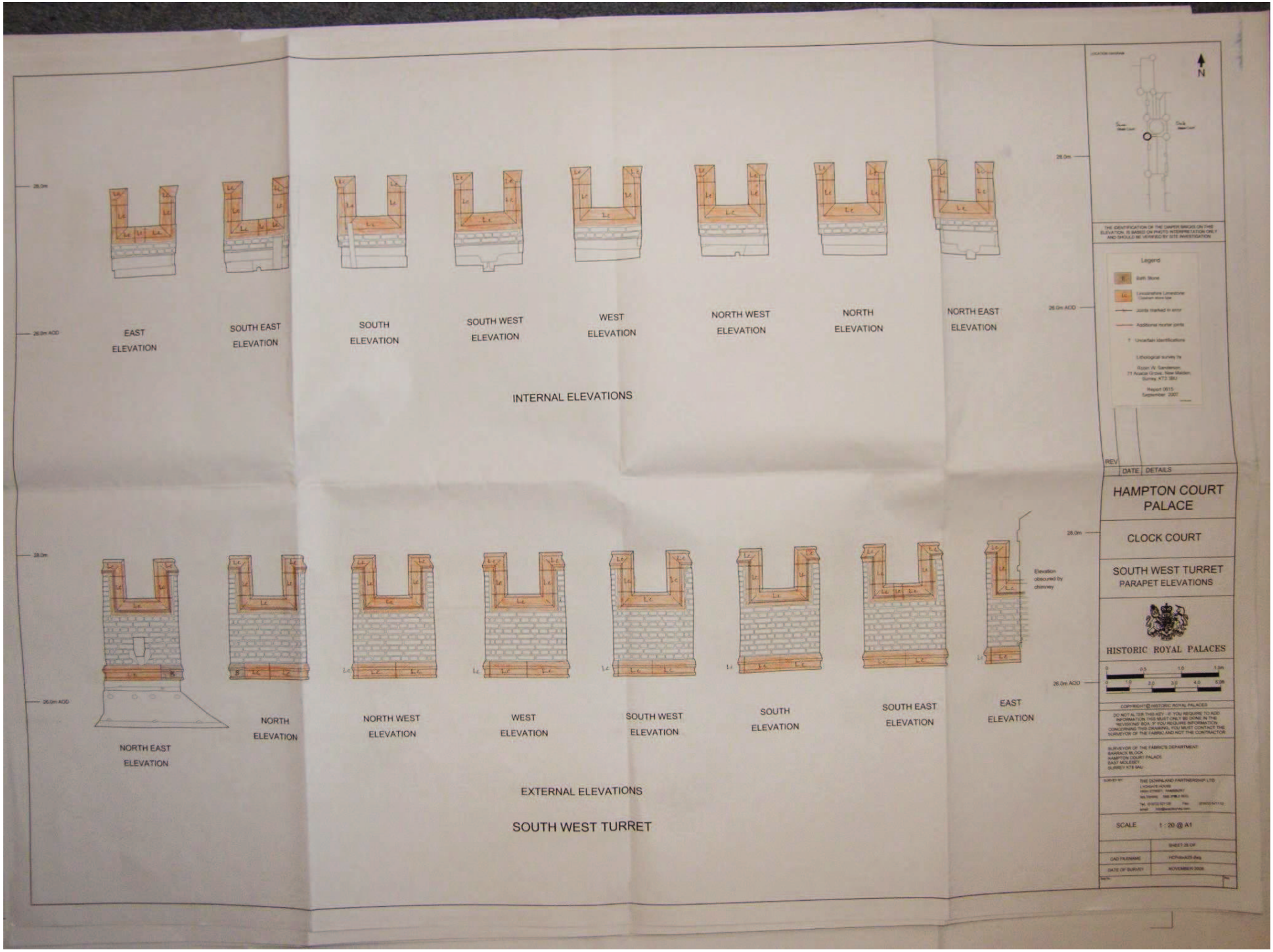
SURVEYOR OF THE FABRICS DEPARTMENT
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
SURVEY BY
THE DOWNLAND PARTNERSHIP LTD
SCALE 1 : 20 @ A1
SHEET 13 OF
CAD FILENAME
DATE OF SURVEY NOVEMBER 2006


EAST ELEVATION
SOUTH EAST ELEVATION
SOUTH ELEVATION
SOUTH WEST ELEVATION
WEST ELEVATION
NORTH WEST ELEVATION
NORTH ELEVATION
NORTH EAST ELEVATION
INTERNAL ELEVATIONS
NORTH EAST ELEVATION
NORTH ELEVATION
NORTH WEST ELEVATION
WEST ELEVATION
SOUTH WEST ELEVATION
SOUTH ELEVATION
SOUTH EAST ELEVATION
EAST ELEVATION
EXTERNAL ELEVATIONS
NORTH EAST TURRET
HAMPTON COURT PALACE
CLOCK COURT
NORTH EAST TURRET
PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
SCALE 1:20 @ A1


EAST ELEVATION
SOUTH EAST ELEVATION
SOUTH ELEVATION
SOUTH WEST ELEVATION
WEST ELEVATION
NORTH WEST ELEVATION
NORTH ELEVATION
NORTH EAST ELEVATION
INTERNAL ELEVATIONS
NORTH EAST ELEVATION
NORTH ELEVATION
NORTH WEST ELEVATION
WEST ELEVATION
SOUTH WEST ELEVATION
SOUTH ELEVATION
SOUTH EAST ELEVATION
EAST ELEVATION
EXTERNAL ELEVATIONS
NORTH WEST TURRET
N
Legend
HAMPTON COURT PALACE
CLOCK COURT
NORTH WEST TURRET
PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
SCALE 1:20 @ A1


EAST ELEVATION
SOUTH EAST ELEVATION
SOUTH ELEVATION
SOUTH WEST ELEVATION
WEST ELEVATION
NORTH WEST ELEVATION
NORTH ELEVATION
NORTH EAST ELEVATION
INTERNAL ELEVATIONS
NORTH EAST ELEVATION
NORTH ELEVATION
NORTH WEST ELEVATION
WEST ELEVATION
SOUTH WEST ELEVATION
SOUTH ELEVATION
SOUTH EAST ELEVATION
EAST ELEVATION
EXTERNAL ELEVATIONS
SOUTH EAST TURRET
N
Legend
HAMPTON COURT PALACE
CLOCK COURT
SOUTH EAST TURRET
PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
SCALE 1:20 @ A1


28.0m
26.0m AOD
EAST ELEVATION
SOUTH EAST ELEVATION
SOUTH ELEVATION
SOUTH WEST ELEVATION
WEST ELEVATION
NORTH WEST ELEVATION
NORTH ELEVATION
NORTH EAST ELEVATION
INTERNAL ELEVATIONS
NORTH EAST ELEVATION
NORTH ELEVATION
NORTH WEST ELEVATION
WEST ELEVATION
SOUTH WEST ELEVATION
SOUTH ELEVATION
SOUTH EAST ELEVATION
EAST ELEVATION
Elevation obscured by chimney
EXTERNAL ELEVATIONS
SOUTH WEST TURRET
N
Legend
Bath Stone
Limestone
Joints marked in error
Additional mortar joints
Uncertain identifications
Lithological survey by
Robin W. Sanderson
71 Acacia Grove, New Malden
Surrey, KT3 3BU
Report 0615
September 2007
REV
DATE
DETAILS
HAMPTON COURT PALACE
CLOCK COURT
SOUTH WEST TURRET
PARAPET ELEVATIONS
HISTORIC ROYAL PALACES
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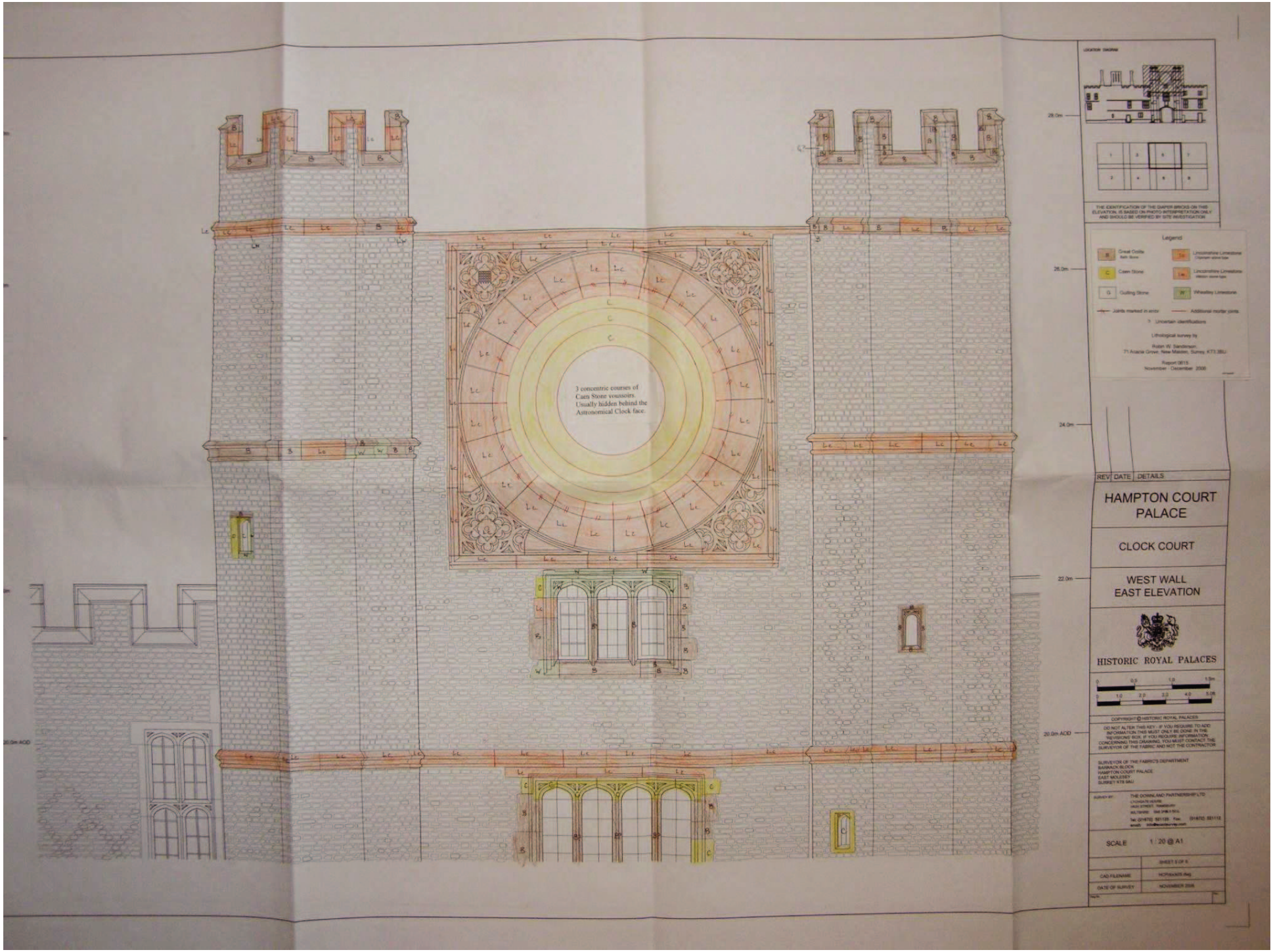
SURVEYOR OF THE FABRIC'S DEPARTMENT
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
THE DOWNLAND PARTNERSHIP LTD
SCALE 1 : 20 @ A1
SHEET 26 OF
DATE OF SURVEY NOVEMBER 2006


3 concentric courses of
Caen Stone voussoirs.
Usually hidden behind the
Astronomical Clock face.
28.0m
26.0m
24.0m
22.0m
20.0m AOD
Legend
Great Oolite
Caen Stone
Guiting Stone
Lincolnshire Limestone
Wheatley Limestone
Joints marked in error
Additional mortar joints
Uncertain identifications
Lithological survey by
Robin W. Sanderson
71 Acacia Grove, New Malden, Surrey, KT3 3BU
Report 0815
November - December 2006
REV
DATE
DETAILS
HAMPTON COURT PALACE
CLOCK COURT
WEST WALL
EAST ELEVATION
HISTORIC ROYAL PALACES
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HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
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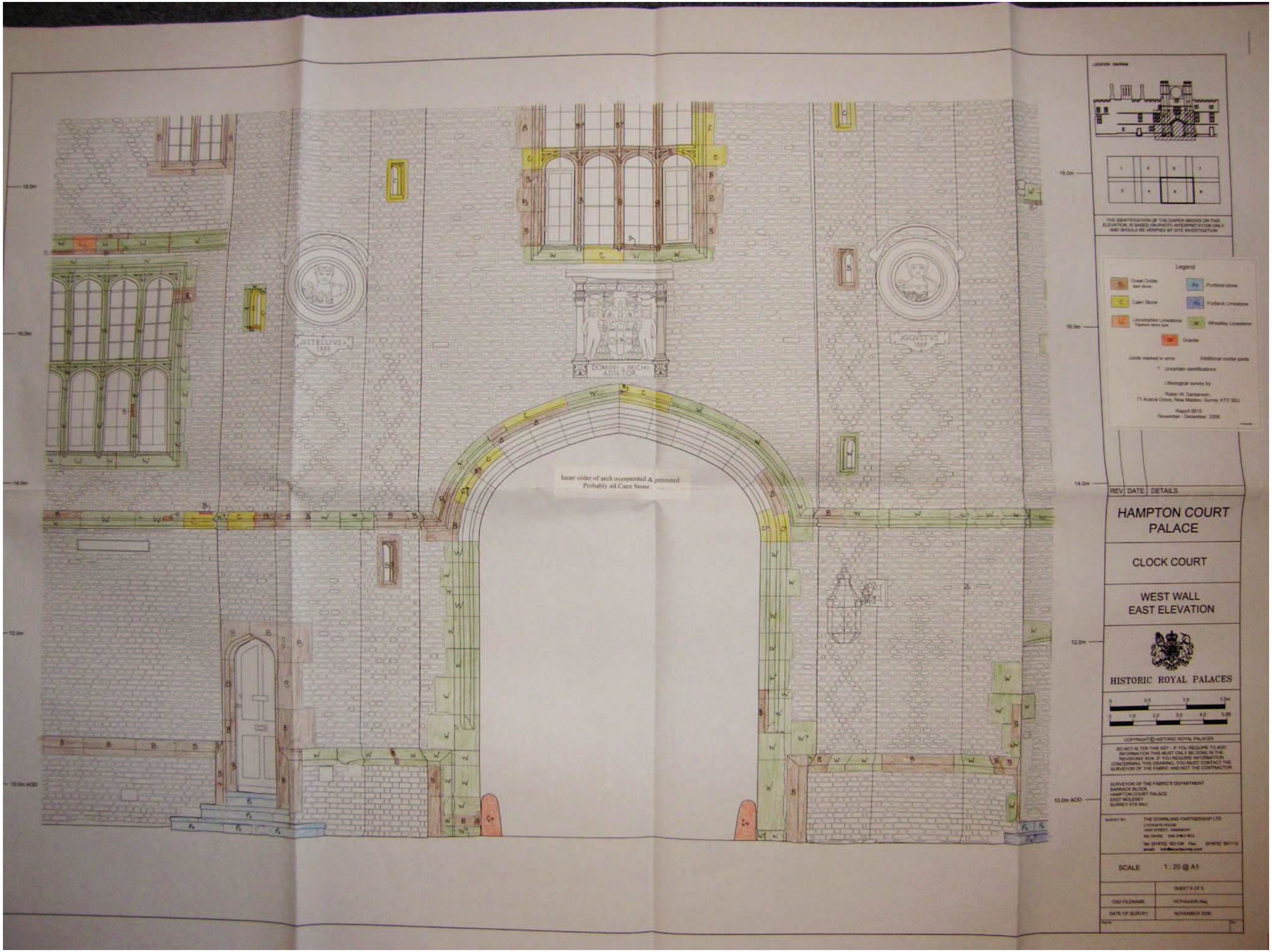
SHEET 5 OF 6
CAD FILENAME
DATE OF SURVEY
NOVEMBER 2006



Inner order of arch overpainted & patinated. Probably all Caen Stone.
VITELLIVS IMP
AVGVSTVS IMP
DOMINE MIHI ADIVTOR
Legend
Lithological survey by
Robin W. Sanderson
71 Acacia Grove, New Malden, Surrey KT3 3BU
Report 0615
November - December 2006
REV DATE DETAILS
HAMPTON COURT PALACE
CLOCK COURT
WEST WALL
EAST ELEVATION
HISTORIC ROYAL PALACES
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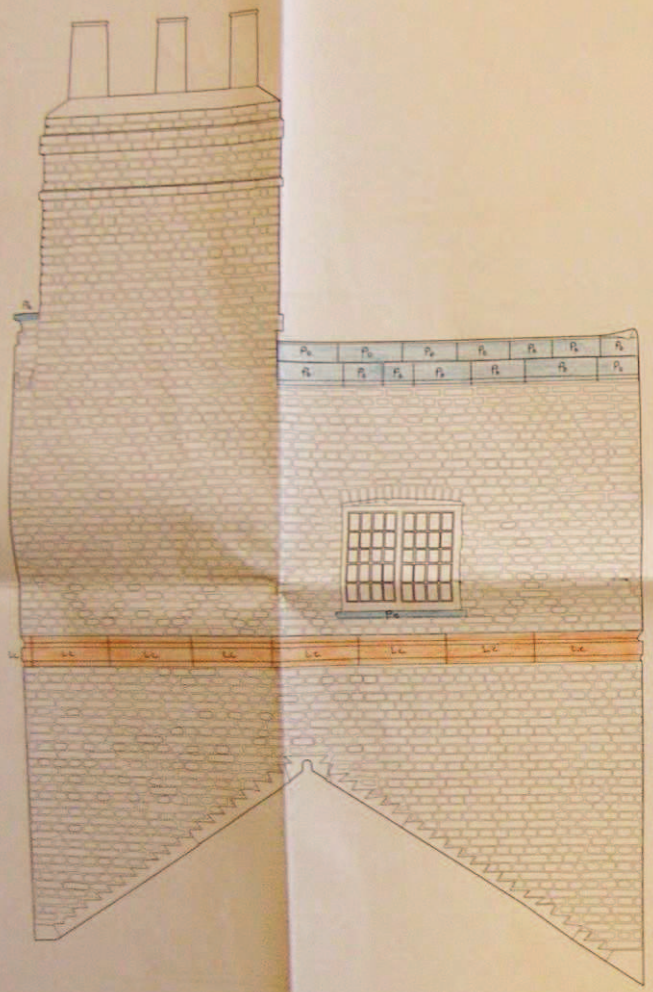
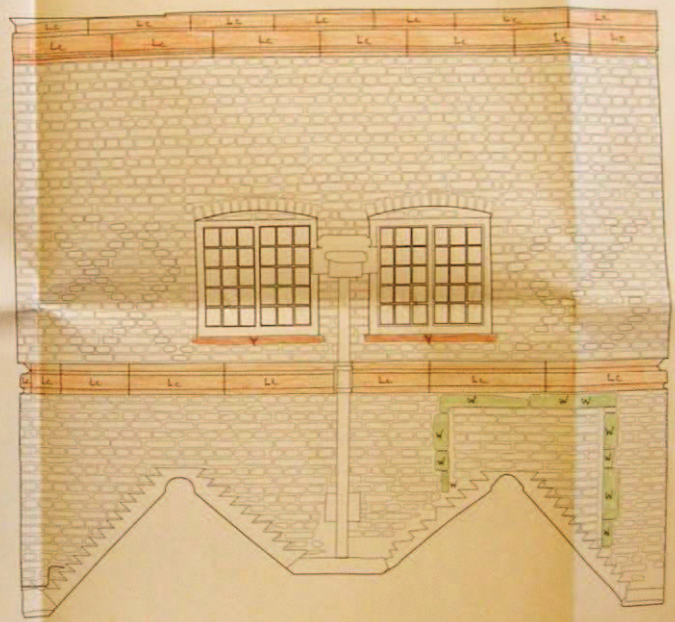
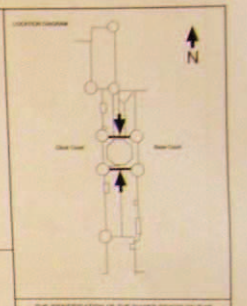
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU
THE DOWNLAND PARTNERSHIP LTD
SCALE 1 : 20 @ A1
CAD FILENAME
DATE OF SURVEY
NOVEMBER 2006
18.0m
16.0m
14.0m
12.0m
10.0m AOD



SOUTH ELEVATION



NORTH ELEVATION



28.0m

26.0m

24.0m

22.0m

20.0m AOD

THE IDENTIFICATION OF THE DAMPER BRICKS ON THIS ELEVATION IS BASED ON PHOTO INTERPRETATION ONLY AND SHOULD BE VERIFIED BY SITE INVESTIGATION

Legend

Lc Lincolnshire Limestone
Oolitic stone type

Pc Portland stone

W Wheatley Limestone

Coal Measures Sandstone
Yorkstone

Joints marked in grey

Additional mortar joints

? Uncertain identifications

Lithological survey by
Robin W. Sanderson
71 Acacia Grove, New Malden, Surrey, KT3 3BU
Report (2010)
November - December 2007

REV.	DATE	DETAILS

HAMPTON COURT PALACE

CLOCK COURT

TOWER
NORTH & SOUTH ELEVATIONS

HISTORIC ROYAL PALACES

0 0.5 1.0 1.5m
0 1.0 2.0 3.0 4.0 5.0ft

SURVEYOR OF THE FABRICS DEPARTMENT
BARRACK BLOCK
HAMPTON COURT PALACE
EAST MOLESEY
SURREY KT8 9AU

SURVEY BY: THE DOWNLAND PARTNERSHIP LTD
LYDGATE HOUSE
HIGH STREET, RAMSBURY
MALTSHIRE SN8 2RB (WILTS)
Tel: 01672 521120 Fax: 01672 521112
email: info@downland.com

SCALE 1 : 20 @ A1

	SHEET 1 OF
CAD FILENAME	HCPsheet10.dwg
DATE OF SURVEY	NOVEMBER 2009

Hampton Court Palace, Anne Boleyn Gatehouse (Base Court Project Phase IV)

Site Code: HCP58

Stonework removed/repaired during works

For locations please refer to architects drawings within the archive file which were marked up on site. Colour slide, black & white and digital images were taken of each stone.

No.	Length (cm)	Width (cm)	Depth (cm)	Comments
1	27	35		Repair to central section of stone course. This was previously repaired with cement.
2	13	46		Replacement of entire section
3	31	23	17	Replacement of section - Arrow loop window
4	61	23	17	Replacement of whole stone - Arrow loop window
5	60	68		Panel - Oriel
6	60	68		Panel - Oriel
7	14	160	20	Replacement of sill above oriel
8	22	21		Replacement of corner (inc. part stone course)
9	22	33		Replacement of stone
10	22	18+39		Replacement of entire corner stone
11	22	47		Pinning or replacement of upper stone coursing (drip)
12	10	25	12	Sill replacement
13	10	18	12	Sill repaired with cement previously. Replacement of repair + stone (part)
14	10	23	12	Sill replacement (part)
15	10	20	12	Sill replacement (part)
16	18	20		Part replace sill
17	30	38		Replace lower corner of panel
18	30	54		Replace lower corner of panel
19	30	54		Replace lower corner of panel
20	22	30		Replace string course
21	22	30+33		Replace string course
22	22	35		String course replacement
23	22	32+30		String course replacement
24	22	46		String course replacement
25	22	26+22		String course replacement
26	22	47.5		String course replacement
27	22	37+26		String course replacement
28	40	23		Arch stone replacement
29	12	44		Indent only
30	20	72		
31	20	94		Arch stone replacement
32	20	61		Arch stone replacement
33	22	28		Arch stone replacement
34	22	12+25		String course replacement
35	22	70		String course replacement
36	22	52		String course replacement
37	22	22+12		String course replacement
38	20	83	20	Crenelation whole stone
39	20	83	20	Whole stone
40	20	83	20	Whole stone

Stonework removed/repaired during works (continued)

41	23	60	20	Top of crenelation
42	21	12+40		String course
43	21	25+40		String course
44	21	43+18		Whole replacement
45	15	87+18		Part replacement
46	15	28		Part replacement
47	21	16+38		Whole
48	21	25		Whole
49	14	91		Part window lintel
50	14	90		Part window lintel
51	14	77		Part replace sill
52	24.5	76		Whole replace sill
53	4	40		Replace torus
54	4	10+5		Replace torus
55	15	38		Replace drip
56	15	28+22		Replace drip only
57		58		Whole stone
58	4	26		Replace torus
59	12	100		Drip replacement of arch (whole)
60	12	15		Drip replacement of arch (part)
61	12	74		Drip replacement of arch (whole)
62	22	24		Drip + torus
63	12	100		Drip only
64	22	55		Drip + torus
65		56+17		Drip
66		37		Drip
67		23+20		Whole
68		45		Drip

APPENDIX IV A SUMMARY OF HISTORIC GRAFFITI RECORDED

by Alison Kelly
Oxford Archaeology
July 2008

1. A Summary of historic graffiti recorded during investigative works
2. Table of recorded graffiti from exterior of gatehouse
3. Examples of recorded graffiti

   (a) Graffiti from room beneath clock room (blocked Wolsey doorway)

   (b) Graffiti from room beneath clock room (Doorway to SE turret)

   (c) Graffiti dated 1711 from lantern cap sarking board

   (d) Graffiti from above hearth within SW turret

   (e) Graffiti from lantern cap leadwork

   (f) Graffiti from sarking board beneath cupola leadwork

   (g) Graffiti from underside of cupola leadwork

   (h) Graffiti from small chimney beside NW turret

   (i) Graffiti within blocked upper section of SE turret

HCP58 Anne Boleyn Gatehouse - Exterior graffiti recorded during survey

No.	*Location*	*Inscription*	*Method of Inscription*	*Date* (from graffiti or from works)	*Recorded* (A - Acetate P - Photo R - Rubbing)
1	SW Turret base brickwork	JEI July 14 1864	Inscribed	1864	A
2	SW Turret base brickwork	ER 1805	Inscribed	1805	A
3	SW Turret base brickwork	HW 1841	Inscribed	1841	A
4	SW Turret base brickwork	DB 1958	Inscribed	1958	A
5	NE Turret downpipe	IG 1714	Initials stamped, date inscribed	1714	A, P
6	NE Turret brick	FTB	Inscribed	Unknown	A
7	SW turret brick	WI (?)	Incised	Unknown	A, P
8	NW Turret Door stonework	Colin Braun [Brown?]	Pencil	Unknown	A, P
9	NE Turret roof doorway stonework	II.W VR [& VR insignia] J.W J.A.B	inscribed	1818	
10	Lead apron of finial	1923 Bown (or Rowen?)	Inscribed	1923	A, P
11	Cap leadwork	P Heffer 1823	Stamped	1823	A, P
12	Cap leadwork	PT	Inscribed	Unknown	A, P
13	Cap leadwork	A Pearse	Inscribed	Unknown	A, P
14	Bell stool	ThiN	Inscribed	Unknown	A, P
15	Cupola leadwork	PK 1975	Inscribed	1975	P
16	Cupola leadwork	George, Goodbye, WMR, M Delee	Inscribed	Unknown	P/A
17	Cupola leadwork	W Hall July 28 1896	Inscribed	1896	P, A
18	Cupola leadwork	JMM Oct 1898	Inscribed	1898	P, A
19	Cupola leadwork	Ken Samways Scaff 1978	Inscribed	1978	P
20	Cupola leadwork	Baz 1979	Inscribed	1979	P
21	Cupola leadwork	John Wegener 1980	Inscribed	1980	P
22	Cupola leadwork	WIGGY 05, TINE 05	Inscribed	2005	P
23	Cupola leadwork	Nosher 04	Inscribed	2004	P
24	Cap sarking board	EC 1711	Inscribed	1711	P, A, R
25	NW Turret chimney	GP Dec 11 1844	Inscribed	1844	P, A, R
26	Cupola sarking boards	1827	inscribed	1827	P, A
27	Cupola sarking boards	TT	Inscribed	Unknown	P, A, R

28	Cupola sarking boards	Sketch of stonemason(?) at work	Pencil	c. 1827	P
29	Cupola sarking boards	Random geometric patterns	Inscribed	c. 1827	P, A, R
30	Cupola sarking boards	T Thorpe 1827 Plumber	Inscribed	1827	P, A,
31	Cupola underside of leadwork	Thomas Taylor Plumber age 30 - Robert King Carpenter age 57 - William Taylor alias Totsey age 29 – 1827	Inscribed	1827	P, A, R
32	Valley sarking board D2	Thise Guters was layd by Harry Ba-----d livd at Hampton & is 42 years of a-- & Allan Conel---- lived at Kingston & 24 July 12 1827	Pencil	1827	P, A
33	Bell frame base (within clock room)	C.M NO.11 TH L. K 1937 Nov P.J.D	Stamped	1937	P, R

Notes:
Item 9 - There is much graffiti in this area and this has been photographed, but is not fully listed here. Item 9 is the oldest dated and most elaborate example.
Items 11, 12, 17, 18 and 31- This graffiti was cut from lead during works and has since been stored in HRP archives.
Item 24 - This sarking board has been stored in HRP archives.
Item 28 - This graffiti was erroneously shaved off the extant sarking board by the leadwork contractor.
Item 30 - This graffiti has been left in situ, all other cupola rib boards were replaced.
Item 32 - This sarking board may have been destroyed by contractor despite request for preservation

Extensive graffiti has been spotted, photographed but not further recorded in these locations: The lower brick and stonework within the gatehouse central stairs; doorways and entrances to turrets.

Graffiti was also extensively found on leadwork on doorway out onto roof but this was of recent date (70's/80s/90s) and therefore not recorded due to limited timescale.

Alison Kelly
March 2008

1. Summary of Graffiti Recorded

Methodology and extent of survey

As with much many parts of the palace (in particular within the Royal Pew of the Chapel Royal) there is a large quantity of graffiti within the gatehouse. The sheer quantity of graffiti located on the gatehouse fabric meant that the recording concentrated on those encountered during the course of the works. Some samples were taken from within the gatehouse interior rooms and from the main access point to the roof to provide context and examples of type, but many remain unrecorded. The recording was mostly done with pen on acetate, however some of the leadwork graffiti was recorded using charcoal rubbing. Some areas of graffiti were also photographed.

The following is an overview of the graffiti observed and recorded during the course of the works.

Description

On the exterior ground floor brick and stonework, many visitors have inscribed their names and these appear to date back to the 19th century opening up of the palace to visitors. Other inscriptions in this area are probably by guards from the barracks who were stationed here and who are depicted in 18th and 19th century drawings stationed beneath the archway of the gatehouse.

Large quantities of graffiti on the upper portion of the gatehouse, particularly on the leadwork, were probably inscribed by workmen. Graffiti without dates can sometimes be put into context by studying the language and associated doodles. It is assumed that most graffiti which includes names and initials is the same name and initials as the person inscribing the graffiti. However we also find various inscriptions that do not give the authors name including a rather poignant *'Goodbye'* inscribed on the cupola leadwork, and it is unlikely that David Bowie ever visited the upper doorway of the NE turret, where his name is written several times. Within the gatehouse, the graffiti origins become difficult to interpret and may have been made by former occupants of the rooms.

Workmen's graffiti

On the whole, workmen's graffiti has been particularly useful on this project for assigning hitherto unknown dates to phases of work.

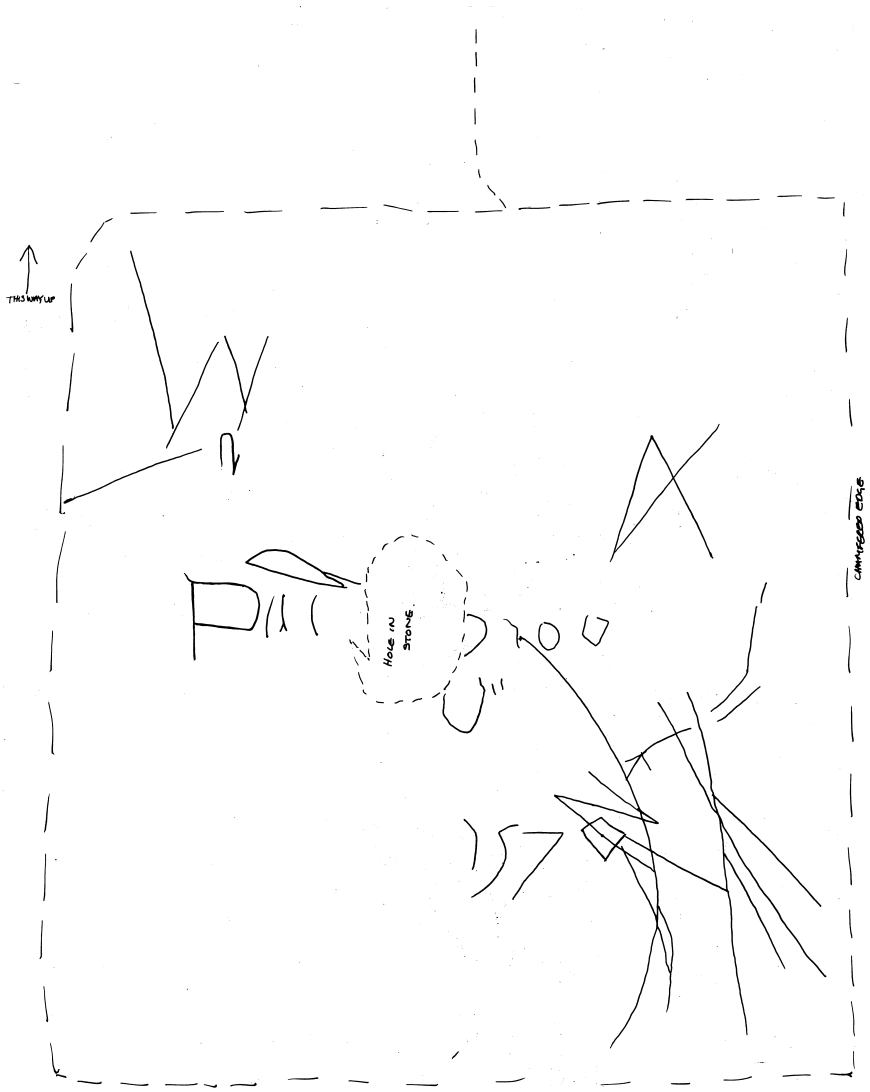
The exact date of the construction of the cupola was unknown until the letters EC and the date 1711 were found deeply cut into one of the topmost lantern cap sarking boards (see (c)). This clearly puts the final stages of construction in 1711, four years after the initial quotation by Wren which is the only written record of the works. Graffiti found on the lead downpipe of the NE turret gives a date of 1714 (see table), suggesting work to the roof of the gatehouse was ongoing. Later works on the cupola included the replacement of sarking boards and the leadwork on the cupola and valley. There were many instance of graffiti with the date 1827 for this work, including (f) and (g) attached.

A moulded brick on the upper section of the chimney adjacent to the NW turret has the date 1844 suggesting this chimney was constructed by this date and not in the later 19th century as thought previously.

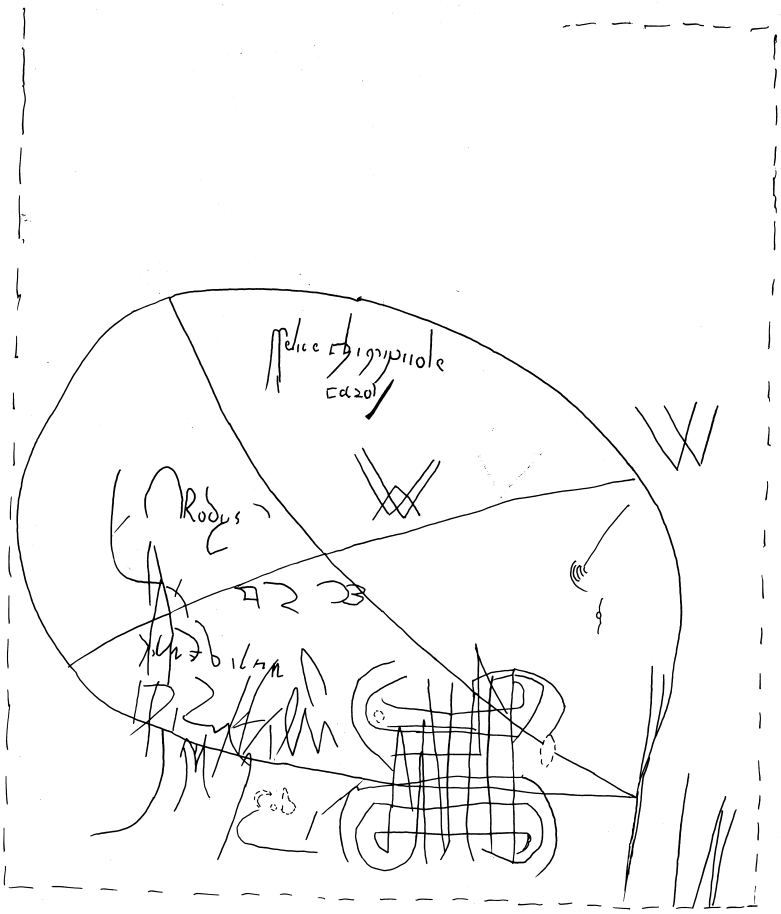
Ritual graffiti

There are several examples of ritual graffiti within the gatehouse. This is mostly concentrated in areas of accommodation, in particular on the stone fire surrounds of the second floor room and the room beneath the clock room, both of which have examples of daisy wheels as well as repetitive patterns. A common form of graffiti seen is the interlocking VV symbol, variations of which are seen within the room beneath the clock room and on the risers of the stone stairs in the blocked upper part of the SE turret (i). The star like symbols incised into the plasterwork above the hearth in the SW turret (d) can also be interpreted as ritual graffiti.

Alison Kelly
Oxford Archaeology
August 2008

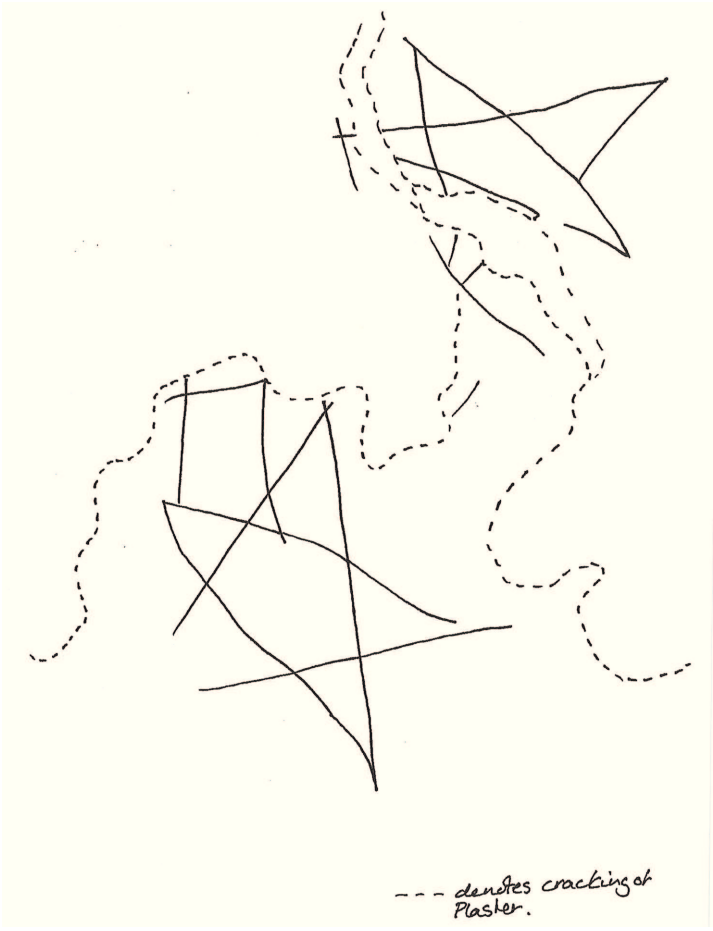


(a) Graffiti from room beneath clock room (blocked Wolsey dooway). Scale 1:2

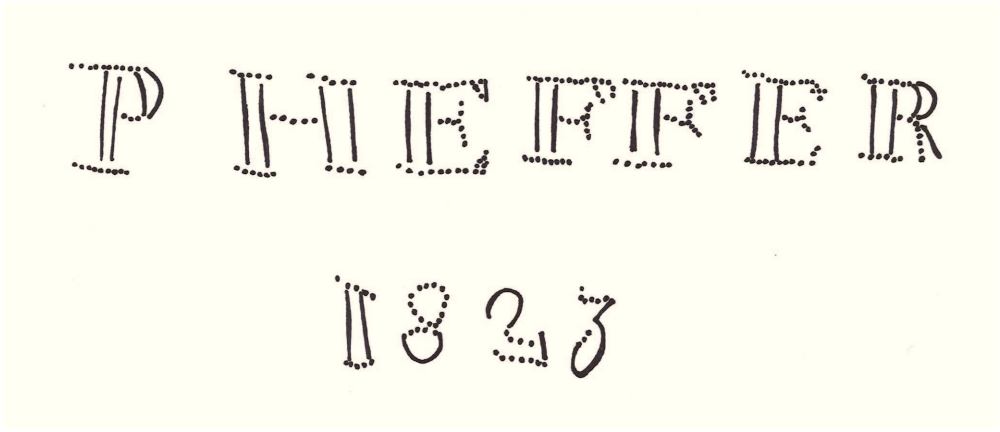


(b) Graffiti from beneath clock room (Doorway to SE turret). Scale 1:2

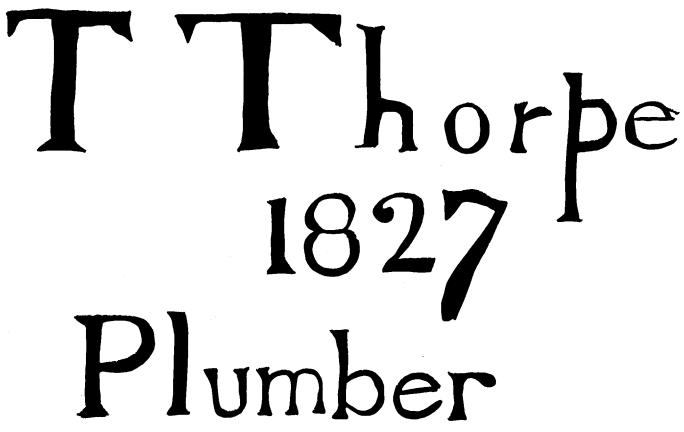
(c) Graffiti dated 1711 from lantern cap sarking board. Scale 1:1



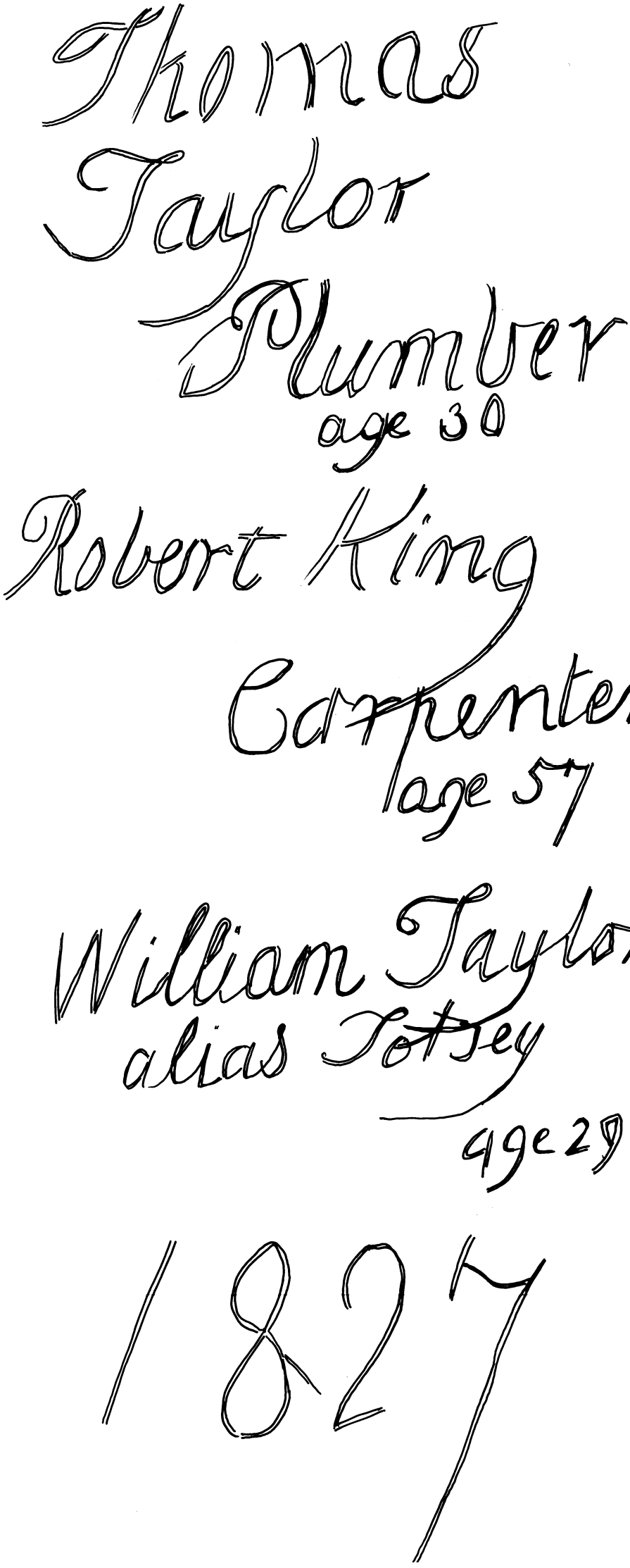
(d) Graffiti from above hearth within SW turret. Scale 1:2



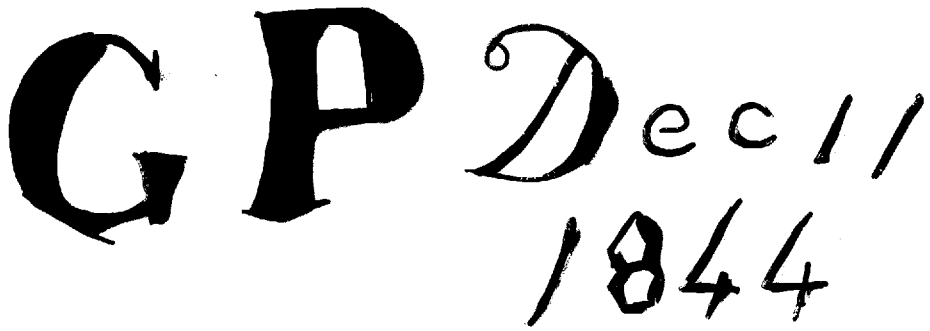
(e) Graffiti from lantern cap leadwork. Scale 1:2



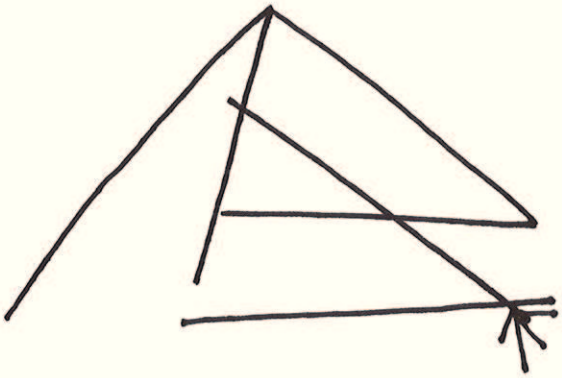
(f) Graffiti from sarking board beneath cupola leadwork. Scale 1:2



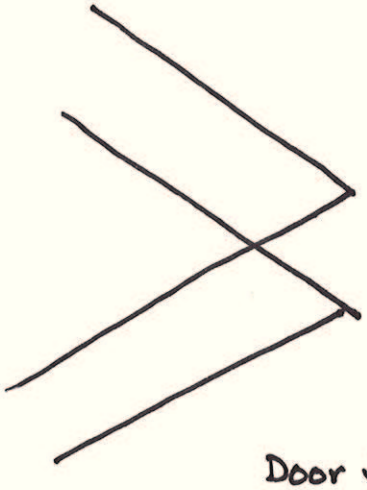
(g) Graffiti from underside of cupola leadwork. Scale 1:2



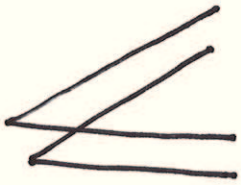
(h) Graffiti from small chimney beside NW turret.
Scale 1:1



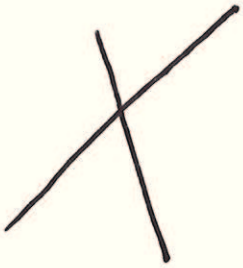
Top Step

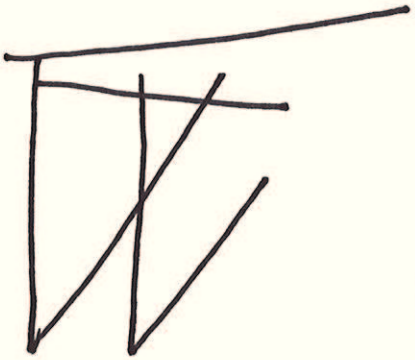


Door Jamb



Third Step





Fourth step

Tenth Step

(i) Graffiti within blocked upper section of SE turret. Scale 1:1

APPENDIX V BLOCKED TURRET SURVEYS

Introduction

A key part of the recording of the gatehouse was the survey of previously inaccessible or unrecorded parts of the four turrets. The surveys took place during the construction works for the exterior repairs and replacement. The following descriptions should be read in conjunction with the figures (figures 10-12) and the relevant plates.

1. The SW (Garderobe) Turret (Figs 11 and 12)

Commonly known as the garderobe turret the SW turret has mostly been incorporated into the accommodation within the gatehouse. The upper section of the SW turret is accessible only via a partially blocked opening within the clock room.

Following removal of the 18/19th century flat leaded roof a full examination was made of the interior of this section. The upper part of the turret consists of crenelations; these were evidently repaired and replaced during the mid 20th century as the upper three courses of brickwork consists of the straw indented bricks as seen elsewhere in the palace on works of this date. The lower part of the crenelation brickwork consists of five courses of type V bricks dating to the 19/20th century

The walling is of 16th century brick with the majority covered in a thick lime based hair plaster. The plaster is very friable and there are large cracks in several places. There is a series of large, flat headed nails within the plaster (approx 1m above floor level) which all have small remnants of lead attached. It was considered that this possibly indicated the base of the turret's original onion type roof, however the plasterwork continues at least 80cm above this level which would have been unnecessary on the inside of a parapet wall. The plaster is difficult to date but it is likely that the decoration of this room dates to its use as a garderobe during the Tudor period. Above the nails to the northern face are two score lines within the plaster; the southern face has a long horizontal rebate cut into the brickwork also approximately at this level.

There are several openings and recesses cut into the elevation, some of which have been infilled with later brickwork. There are two blocked windows which would have faced out onto Base Court. There is no external sign of these windows as the turret was refaced in the early 18th century and it is likely the windows were infilled at this time. The infill brickwork appears 18th century in date. The stonework has some chamfered edges visible but is mostly hidden by the infilling brickwork and plaster.

The main feature of the room is a small brick lined hearth which is built into the SE walling. The brickwork for the base of the hearth is later in date, probably 17/18th century. The upper part is recessed into the Tudor brickwork. Above the hearth there is an incised star shaped pattern in the plaster (see Appendix IV) which is possibly apotropaic in origin.

The floor is of oak planks, roughly laid, with gaps between the edges of the planks and the walls. An opening has been cut, presumably to allow the two lead pipes down to the floor below. The ceiling of the room below is approximately 30cms below the floor level, but

much obscured by debris. The room beneath this was converted into a toilet for the grace and favour apartment during the 18th century.

2. The SE turret

The SE turret contains a staircase which rises to the top of the turret. The lower portion of the stair is currently used by the shop as access to staff quarters. There are many graffiti on the stonework, some of which appear early in date. A sacred/bleeding heart motif is particularly repeated. The uppermost part of the stair is blocked by a wooden partition, which was partially opened to allow access for the survey. The turret stairs rise to approximately 2.6m below the lead roof.

A stone doorway at the topmost level is also partially visible from within the clock room. This doorway has been boarded up, probably in the 19th century, although a small section has been removed, presumably as part of earlier investigations. The jamb stonework has some incised graffiti and two strap hinges of uncertain date. There are also rebates and holes which presumably are for other door fittings. The stonework within the turret has been limewashed.

The interior of the turret has a plaster coating. The uppermost 3 courses of brickwork are later in date (probably 19th/20th century) and do not have plaster. The brickwork at this point was probably inserted during replacement of the roof and crenelations. There are many interior repairs and there are reoccurring gouge marks in the plaster at the same height as the uppermost stair, and possibly relating to a platform at this point, however the gouges do not penetrate the brickwork. There are 3 patches of infill using roof tiles which have been set on edge. The tiles have nail holes at one end and their approximate size is 16 x 26cms. There are also some voids filled with upright bricks – the voids are mostly connected with straight joints. One infill patch was possibly part of repairs during stone replacement of the 19th century. The bricks are reused Type B bricks but one brick is orangey red in colour and possibly 17/18th century in date. The interior space of the turret is difficult to phase as the mortars are very similar.

As with the SW turret there are a series of nails encircling the turret, however there are no lead fragments and the height of the nails varies. One nail has fragments of paper or card on it. There is a shelf inserted into the wall at one side but removed from the hole in the brickwork on the other side. The wood is the same type and quality as used in the doorway. The shelf use and date is unknown.

The stone steps have a re-occurring mark incised on the riser (see Appendix IV (i)). This graffiti is in the form of an interlocking VV which is often used as an apotropaic marking. The bottom step in this section has a small masons mark inscribed.

3. NW turret (Fig 10)

Commonly known as the bell turret, the interior spaces have undergone many repairs and changes with the changing use of the turret. The majority of the turret is inaccessible,

however the lower level and uppermost level were examined and recorded as part of the investigation. Further areas could be seen through the arrow loop windows in the centre of the turret.

The lower part of the turret is accessed by a small door which is up several of the steps inserted by Henry VIII which lead up to the great hall. The bell turret houses the clock weights which are no longer used and instead have been lowered to the ground level. The ropes have been loosely piled on a wooden platform which has been inserted at the same level as the entrance to the turret – approximately 108cm above ground level. The platform covers two thirds of the interior space and is roughly built of softwood. There is a timber partition which rises from the platform to the platform at the upper level surveyed above. There is a doorway which has been cut in the partition which is of uncertain date.

The interior of the base of the turret is faced with an orangey red brick, laid in an English bond (presumably to add structural strength to the base of the turret) with a thin section of hard greyish white mortar. Initially thought to be type T 19th century brick as used on the facing outside, but measurements (21-23 x 5.7-6.1 x 9.8-10.8cm) suggest the brickwork is closer in type to type G, Wren Kentish Stock brick. There were a large number of repairs undertaken to the turret in the early 18th century but these used a different type of brick. There are missing bricks in the walling which probably relate to earlier platforms or a slightly different platform arrangement. There are rings and hooks set into the walls and a lead pipe which disappears into the wall halfway up the face. The facing is several bricks deep and forms a rectangular shape within the turret. This build up of brickwork is probably part of the stabilising works to the bell turret which was in a 'ruinous' state in 1707.

There are several instances of Reigate stone set within the facing. Due to the condition of the stone it appears to be reused. The reason for its insertion into the facing is unclear.

The upper part of the turret is accessed through a doorway in the clock room. The doorway is timber with a large curved lintel, cut to reflect the bend of the turret. One jamb is covered with bricks and there is a straight joint beneath the outer edge of the lintel suggesting this doorway is later and infilled an earlier larger opening. The bricks used for this rebuild are a mixture of Tudor and 18th century. Tiles are used in several locations, particularly around the lintel.

The main/primary brickwork is of 16th century date and mostly laid in a header bond with a creamy lime mortar. The brickwork was rendered at some point but the majority of this has since been removed.

The interior at this level shows many different areas of repair. There are nine visible concrete rectangular ties which have been inscribed by hand with the date 13-2-63. These ties are located at intervals along large seemingly structural cracks. The sizes of the ties vary and some are angled to accommodate the curvature of the elevation. There is a large patch of reused 18/19th century brick which runs approximately 240cm from the platform to the upper part of the wall.

The timber platform covers approximately ¾ of the area, with a large opening left for the

clock weights to hang down. Above this opening is a large timber beam inserted into the wall. This is inserted into the wall at either end and is supported by struts beneath. There are areas of patching a repair around the beam suggesting this has been reset or is a later insertion. The beam has various wheels and hooks fixed to it and a cable runs from a wheel to the metal fixture beside the door.

Beneath this beam the wall has a hollow in the brickwork which appears to have been formed by wear. This hollow is about 10cm deep at the centre and the walling in this area is covered with render.

The area beneath this platform is not accessible and is section by a timber partition. The middle section could partially be seen from the arrow loop windows. The large cracks seen within the upper levels continue downwards. The depth of the facing bricks in the lower section can also be seen. There is a blocked doorway partially visible at the same level as the windows. This is the blocked doorway seen within the room beneath the clock room and was probably infilled during the Henrician phase of works.

Alison Kelly
January 2008

APPENDIX VI BRICKWORK ANALYSIS AND COMPARISON TO BRICK TYPOLOGY

By Alison Kelly
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July 2008

Analysis of brickwork

The following spreadsheets show the results of the brickwork analysis undertaken during the survey. The aim of this work was to compare the sizes and descriptions of the brickwork on the elevations of the gatehouse to those identified on the phase elevations and brick typology produced by Daphne Ford for English Heritage in 1991.

The brickwork was recorded on site using an Oxford Archaeology brick data sheet. Using this sheet ensured all categories included within the typology were accounted during investigations, and enabled easy cross referencing to the brick typology as well as other elements of the recording programme (photographic, drawn and written).

The brick measurements taken during the survey were recorded on an Excel spreadsheet and an average measurement for each dimension was produced and compared to the Typology. Since measurements in archaeological recording are taken in centimetres, the Typology measurements were converted to centimetres to facilitate comparison. The size analysis was undertaken in conjunction with the description of the brickwork and any differences were further investigated.

Hampton Court Palace - Anne Boleyn Gatehouse

Brick measurements corresponding to those shown on phased elevations

Type A - Pre Wolsey and Wolsey Stock Brick c. ? - 1528
Surface texture very uneven, friable occasional pebbles included. No frog. Diaperwork using vitrified headers. Occasional straw and stock imprints on brick. Pointing is double struck.

Type I - Wren stock brick (selected for dark colour)
Uneven surface, Hard, No significant inclusions. Frog unknown. Penny roll pointing

Type Q - Malms, Seconds, Washed Stocks, Grey Stocks
Smooth surface texture with sharp arris. Inclusions include cinder particles resulting in grey spotted surface. Pointing usually flat but sometimes penny rolled or scored. Grey/white cementitious mortar.

Type V - Stock brick 19th/20th C

Rough textured brick with particles of dark and pale orange clay. Flat pointed with grey/white gritty lime bed mortar.

Modern - c. 1950/60s
Rough textured brick with sharp arris and distinctive straw impressions on faces. Mortar is hard and creamy with many small stone inclusions.

Type A - Pre Wolsey and Wolsey Stock Brick (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.9	24.1	10.4	25.6	NE Turret
5.2	23.6	11.1	25.8	NE Turret
5.3	23.6	10.9	25.5	NE Turret
5.8	24	11.2	26	NE Turret
5.6	23.6	11.4	24.8	NE Turret
5.6	23.8	10.9	25.4	NE Turret
5.6	22.9	11	25.4	NE Turret
5.6	23.4	11.1	25.6	NE Turret
4.4	22	12	26	SE Turret
4.6	24.2	11.6	25.3	SE Turret
4	24	11.6	25.4	SE Turret
5	23.2	11.9	25.5	SE Turret
5.2	24	11.5	25.4	SE Turret
5.5	24.6	12	25	SE Turret
5.1	25	11	25.9	SE Turret
5	25.5	11.6	25.7	SE Turret
5.7	25	12	25.7	SE Turret
5.5	25	12	25.5	SE Turret
5.5	24.6	11.2	25.8	SE Turret
4.5	24.2	11.4	26	SE Turret
5	22.8	11.2	25.7	SE Turret
5.5	25	11	25.8	SE Turret
5.9	24	11.6	25.2	SE Turret
6	23.7	11.9	25.4	SE Turret
5.2	23.6	12	25.7	West Elevation
5.3	23.2	11.7	26.2	West Elevation
5.2	24.5	11.4	25.8	West Elevation
5.4	23.5	11.3	25.6	West Elevation
5.5	24.5	11.4	25.2	West Elevation
5.2	24.5	12.1	25.7	West Elevation
5.2	24.6	11.1	26.5	West Elevation
5	24.6	11.4	25.5	West Elevation
4.9	23.8	11.2	26.5	West Elevation
5.2	24	11.5	25.2	West Elevation
5.5	24.2	11.6	25.5	West Elevation
5.6	24.1	11.9	26.1	West Elevation

5.3	24.9	12	26.4	West Elevation
5.5	23.8	11.8	26.1	West Elevation
5.7	24.8	11.5	26.4	West Elevation
4.9	25.1	11.3	27	West Elevation
Average (Inches)				
2.1	9.7	4.6	10.4	
HCP Measurements (Inches)				
2-2.5	9.5-10.25	4.25-4.75	10.5-11	

Type I Wren Stock Bricks (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
6.5	22	10.2	28	East Elevation Plinth
6.5	22.2	10.5	29	East Elevation Plinth
6.5	22	10.7	28.5	East Elevation Plinth
5.9	22.4	10.5	28.6	East Elevation Plinth
Average (Inches)				
2.5	8.7	4.1	11.2	
HCP Measurements (Inches)				
2.25-2.5	8.5-9	4-4.25	11-11.5	

Type Q Malms - Seconds - Washed Stocks - Grey Stocks (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
6.4	22	10.5	28.9	SE Turret Base
6.3	21.9	10.6	28.4	SE Turret Base
6.6	22.4	10.9	29.1	SE Turret Base
6.8	22.6	10.1	29.2	SE Turret Base
Average (Inches)				
2.6	8.8	4.1	11.4	
HCP Measurements (Inches)				
2.5-2.75	8.5-9.5	4-4.5	11.0-12.0	

Type V Stock Brick (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.4	23	10.5	27.3	SE Turret
5.5	22.8	11.5	26.8	SE Turret
5.8	23	10.9	26.2	SE Turret
5.4	23.3	11.1	26.2	SE Turret
5.2	22.5	12.5	26.6	SE Turret
5.6	22.6	10.6	26.8	SE Turret
5.6	23.3	11.3	26	SE Turret
5.2	23.5	11.2	25.5	SE Turret
Average (Inches)				
2.10	9.10	4.40	10.40	
HCP Measurements (Inches)				
2-2.75	8.75-9.5	4-4.75	11	

Modern c. 1950/60's (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
21.8	10.4	5.2	27	West Elevation
21.7	10.1	5.6	26.7	West Elevation
21.4	10.2	5.9	27	West Elevation

21.8	10.4	5.4	26.4	West Elevation
21.5	10.4	5.6	25.5	West Elevation
21.3	10.2	5.7	26	West Elevation
21.5	10.2	5.6	27.2	West Elevation
21.2	10.3	5.3	26	West Elevation
21.1	9.9	5.5	26.1	Clock Court NE Turret
21.6	10.2	5.6	26.7	Clock Court NE Turret
20.6	10.5	5.9	26.5	Clock Court NE Turret
20.1	11	5.5	26	Clock Court NE Turret
21.4	9.8	5.7	26.2	Clock Court NE Turret
21.8	10.4	5.5	25.5	Clock Court NE Turret
21.7	10.2	5.4	25.9	Clock Court NE Turret
21.8	9.9	5.3	26	Clock Court NE Turret

Average (Inches)

8.4	4	2.2	10.4

HCP Measurements (Inches)

N/A

Alison Kelly
May-08

Hampton Court Palace - Anne Boleyn Gatehouse

Brick measurements different, and in addition to, those shown on phased elevations

External brickwork NW turret (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.4	19.8	8.7	24.9	NW Turret - pre raking out
5.1	19.8	8.8	25	NW Turret - pre raking out
5.5	19.9	8.5	25	NW Turret - pre raking out
5	19.1	8.9	*	NW Turret - pre raking out
5	20	8.8	*	NW Turret - pre raking out
5.20	**19.72**	**8.74**	**24.97**	**Average**
6	20.4	9.5	26.1	NW Turret - post raking out
6.1	20.4	9.4	26	NW Turret - post raking out
6.3	20.5	9.6	25.9	NW Turret - post raking out
6.3	20.3	9.6	25.8	NW Turret - post raking out
6.2	20.4	9.4	26	NW Turret - post raking out
6.2	20.6	9.6	26.3	NW Turret - post raking out
6	20.5	9.6	25.7	NW Turret - post raking out
6.1	20.4	9.6	25.6	NW Turret - post raking out
6.15	**20.44**	**9.54**	**25.93**	**Average**

TYPE: Both pre and post raking out stretcher measurements are too small for 19th century bricks and does not match known 18th century type. Pictorial evidence suggests unknown 18th century gauged brickwork which was later raked back to accommodate addition of black ash mortar.

Internal brickwork NW turret (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
6.1	20.3	10.8	25.2	Entrance
5.7	22.4	10.4	25.5	Entrance
5.8	23	10.6	25.2	Entrance
5.7	21.7	10.5	*	Entrance
5.7	22	10.1	*	Entrance
6.2	22	10.4	*	Entrance
5.87	**21.90**	**10.47**	**25.30**	
6	21.2	9.8	25.7	Turret core
6	21	9.8	26	Turret core
5.9	21.1	9.8	25.7	Turret core
6	21	9	26	Turret core
6	21.3	10	25.8	Turret core
6	21.1	10	26	Turret core
5.98	**21.12**	**9.73**	**25.87**	

TYPE: Unknown but porbably 18th/19th century in date.

Upper portion of gatehouse identified as inaccessible (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.6	23.7	11	25.9	South Elevation
5.5	24.2	11.5	26.5	South Elevation
5.7	24.5	11.8	26.8	South Elevation
5.7	24.9	12	27	South Elevation
5.5	25	11.8	27.6	North Elevation
5.6	24.7	11.7	27.3	North Elevation
5.6	24.2	11.2	26.4	North Elevation
5.5	24.7	11.9	26.9	North Elevation
5.4	26	12.1	26.2	North Elevation
5.2	25.4	12	26.4	North Elevation
5.7	24.9	12.2	27	North Elevation
5.2	24.8	11.9	26.2	North Elevation
5.3	23.2	11	26.2	North Elevation
5.5	24.4	11.2	27.4	North Elevation
5.2	23.3	11.2	27.3	North Elevation
5.5	24.2	11.3	26.4	North Elevation
5.2	24.5	11.3	26	North Elevation
6	23.7	11.7	25.9	North Elevation
5.6	23.6	11.8	25.8	North Elevation
5.4	24.6	11.8	26.2	North Elevation
5.50	**24.43**	**11.62**	**26.57**	**Average**

TYPE: Large stretcher measurements indicates these bricks are Type A Wolsey phase bricks probably dating to the primary construction phase of the gatehouse. Vitrified diaperwork is present on both faces. The windows are a later insertion with a similar lime mortar, probably reusing Type A bricks. The style of window suggests part of early 18th century works.

North elevation infill (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.4	21.6	*	27.4	North Elevation - Doorway Infill
5.8	21.6	*	27.2	North Elevation - Doorway Infill
5.5	21.6	*	27.4	North Elevation - Doorway Infill
5.6	22	*	27	North Elevation - Doorway Infill
5.5	22	*	26.8	North Elevation - Doorway Infill
5.9	21.5	*	*	North Elevation - Doorway Infill
6	21.9	*	*	North Elevation - Doorway Infill
5.8	21.8	*	*	North Elevation - Doorway Infill
5.7	21.5	*	27.2	North Elevation - Doorway Infill
5.8	21.2	*	26.5	North Elevation - Doorway Infill
5.6	21.7	*	27	North Elevation - Doorway Infill
5.5	21.4	*	27	North Elevation - Doorway Infill
5.68	**21.65**	*	**27.06**	**Average**

TYPE: Potentially Type C or D Henrician phase bricks. Mortar unseen as this infilling had been recently repointed. Bricks may have been reused. The assumption is that the window was infilled during the astronomical clock insertion.

South elevation chimney stack (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
6.5	22.6	10.6	29.1	South Chimney Stack
6.7	21.8	10.6	29.6	South Chimney Stack
6.7	22.2	10.6	30.7	South Chimney Stack
6.8	22.2	10.6	29.4	South Chimney Stack
6.8	22.4	10.7	29.7	South Chimney Stack
6.2	22.7	10.3	29.6	South Chimney Stack
6.5	22.4	10.5	30.2	South Chimney Stack
6.6	22.1	10.4	31.1	South Chimney Stack
6.60	**22.30**	**10.54**	**29.93**	**Average**

TYPE: Size fits with Type Q bricks (late 18th to 19th century). Mortar and bond different to main brickwork on south elevation.

South elevation infill (cms)

Height	*Stretcher*	*Header*	*Arris to Arris*	*Location*
5.8	22.8	10.7	26.1	South - Window Infill
5.9	23	10.8	26.6	South - Window Infill
5.9	23	11.2	26.3	South - Window Infill
6.1	23	10.7	26.9	South - Window Infill
5.93	**22.95**	**10.85**	**26.48**	**Average**

TYPE: Size and description consistent with Type T bricks - 19th century red stock bricks

Alison Kelly
Feb-09

HCP58BS Hampton Court Palace - Anne Boleyn Gatehouse

Measurements taken during survey

Measurements in cms				Type	Location
L	W	D	Arris to Arris		
6.5	22.6	10.6	29.1	Q	South Chimney Stack
6.7	21.8	10.6	29.6	Q	South Chimney Stack
6.7	22.2	10.6	30.7	Q	South Chimney Stack
6.8	22.2	10.6	29.4	Q	South Chimney Stack
6.8	22.4	10.7	29.7	Q	South Chimney Stack
6.2	22.7	10.3	29.6	Q	South Chimney Stack
6.5	22.4	10.5	30.2	Q	South Chimney Stack
6.6	22.1	10.4	31.1	Q	South Chimney Stack
5.6	23.7	11	25.9	A	South Elevation
5.5	24.2	11.5	26.5	A	South Elevation
5.7	24.5	11.8	26.8	A	South Elevation
5.7	24.9	12	27	A	South Elevation
5.8	22.8	10.7	26.1	T	South - Window Infill
5.9	23	10.8	26.6	T	South - Window Infill
5.9	23	11.2	26.3	T	South - Window Infill
6.1	23	10.7	26.9	T	South - Window Infill
5.9	24.1	10.4	25.6	A	NE Turret
5.2	23.6	11.1	25.8	A	NE Turret
5.3	23.6	10.9	25.5	A	NE Turret
5.8	24	11.2	26	A	NE Turret
5.6	23.6	11.4	24.8	A	NE Turret
5.6	23.8	10.9	25.4	A	NE Turret
5.6	22.9	11	25.4	A	NE Turret
5.6	23.4	11.1	25.6	A	NE Turret
5.5	21.1	9.9	26.1	Modern	NE Turret
5.6	21.6	10.2	26.7	Modern	NE Turret
5.9	20.6	10.5	26.5	Modern	NE Turret
5.5	20.1	11	26	Modern	NE Turret
5.7	21.4	9.8	26.2	Modern	NE Turret
5.5	21.8	10.4	25.5	Modern	NE Turret
5.4	21.7	10.2	25.9	Modern	NE Turret
5.3	21.8	9.9	26	Modern	NE Turret
4.4	22	12	26	A	SE Turret
4.6	24.2	11.6	25.3	A	SE Turret
4	24	11.6	25.4	A	SE Turret
5	23.2	11.9	25.5	A	SE Turret
5.2	24	11.5	25.4	A	SE Turret
5.5	24.6	12	25	A	SE Turret
5.1	25	11	25.9	A	SE Turret
5	25.5	11.6	25.7	A	SE Turret
5.7	25	12	25.7	A	SE Turret
5.5	25	12	25.5	A	SE Turret
5.5	24.6	11.2	25.8	A	SE Turret
4.5	24.2	11.4	26	A	SE Turret
5	22.8	11.2	25.7	A	SE Turret
5.5	25	11	25.8	A	SE Turret
5.9	24	11.6	25.2	A	SE Turret
6	23.7	11.9	25.4	A	SE Turret
5.4	23	10.5	27.3	V	SE Turret
5.5	22.8	11.5	26.8	V	SE Turret

Measurements in cms				Type	Location
L	W	D	Arris to Arris		
5.8	23	10.9	26.2	V	SE Turret
5.4	23.3	11.1	26.2	V	SE Turret
5.2	22.5	12.5	26.6	V	SE Turret
5.6	22.6	10.6	26.8	V	SE Turret
5.6	23.3	11.3	26	V	SE Turret
5.2	23.5	11.2	25.5	V	SE Turret
6	20.4	9.5	26.1	Unknown - 18th C	NW Turret - post raking out
6.1	20.4	9.4	26	Unknown - 18th C	NW Turret - post raking out
6.3	20.5	9.6	25.9	Unknown - 18th C	NW Turret - post raking out
6.3	20.3	9.6	25.8	Unknown - 18th C	NW Turret - post raking out
6.2	20.4	9.4	26	Unknown - 18th C	NW Turret - post raking out
6.2	20.6	9.6	26.3	Unknown - 18th C	NW Turret - post raking out
6	20.5	9.6	25.7	Unknown - 18th C	NW Turret - post raking out
6.1	20.4	9.6	25.6	Unknown - 18th C	NW Turret - post raking out
5.4	19.8	8.7	24.9	Unknown - 18th C	NW Turret - pre raking out
5.1	19.8	8.8	25	Unknown - 18th C	NW Turret - pre raking out
5.5	19.9	8.5	25	Unknown - 18th C	NW Turret - pre raking out
5	19.1	8.9	*	Unknown - 18th C	NW Turret - pre raking out
5	20	8.8	*	Unknown - 18th C	NW Turret - pre raking out
5.2	23.6	12	25.7	A	West Elevation
5.3	23.2	11.7	26.2	A	West Elevation
5.2	24.5	11.4	25.8	A	West Elevation
5.4	23.5	11.3	25.6	A	West Elevation
5.5	24.5	11.4	25.2	A	West Elevation
5.2	24.5	12.1	25.7	A	West Elevation
5.2	24.6	11.1	26.5	A	West Elevation
5	24.6	11.4	25.5	A	West Elevation
4.9	23.8	11.2	26.5	A	West Elevation
5.2	24	11.5	25.2	A	West Elevation
5.5	24.2	11.6	25.5	A	West Elevation
5.6	24.1	11.9	26.1	A	West Elevation
5.3	24.9	12	26.4	A	West Elevation
5.5	23.8	11.8	26.1	A	West Elevation
5.7	24.8	11.5	26.4	A	West Elevation
4.9	25.1	11.3	27	A	West Elevation
5.2	21.8	10.4	27	Modern	West Elevation
5.6	21.7	10.1	26.7	Modern	West Elevation
5.9	21.4	10.2	27	Modern	West Elevation
5.4	21.8	10.4	26.4	Modern	West Elevation
5.6	21.5	10.4	25.5	Modern	West Elevation
5.7	21.3	10.2	26	Modern	West Elevation
5.6	21.5	10.2	27.2	Modern	West Elevation
5.3	21.2	10.3	26	Modern	West Elevation
5.5	25	11.8	27.6	A	North Elevation
5.6	24.7	11.7	27.3	A	North Elevation
5.6	24.2	11.2	26.4	A	North Elevation
5.5	24.7	11.9	26.9	A	North Elevation
5.4	26	12.1	26.2	A	North Elevation
5.2	25.4	12	26.4	A	North Elevation
5.7	24.9	12.2	27	A	North Elevation
5.2	24.8	11.9	26.2	A	North Elevation
5.3	23.2	11	26.2	A	North Elevation
5.5	24.4	11.2	27.4	A	North Elevation
5.2	23.3	11.2	27.3	A	North Elevation
5.5	24.2	11.3	26.4	A	North Elevation

Measurements in cms				Type	Location
L	W	D	Arris to Arris		
5.2	24.5	11.3	26	A	North Elevation
6	23.7	11.7	25.9	A	North Elevation
5.6	23.6	11.8	25.8	A	North Elevation
5.4	24.6	11.8	26.2	A	North Elevation
5.4	21.6	*	27.4	C	North Elevation - Doorway Infill
5.8	21.6	*	27.2	C	North Elevation - Doorway Infill
5.5	21.6	*	27.4	C	North Elevation - Doorway Infill
5.6	22	*	27	C	North Elevation - Doorway Infill
5.5	22	*	26.8	C	North Elevation - Doorway Infill
5.9	21.5	*	*	C	North Elevation - Doorway Infill
6	21.9	*	*	C	North Elevation - Doorway Infill
5.8	21.8	*	*	C	North Elevation - Doorway Infill
5.7	21.5	*	27.2	C	North Elevation - Doorway infill
5.8	21.2	*	26.5	C	North Elevation - Doorway infill
5.6	21.7	*	27	C	North Elevation - Doorway infill
5.5	21.4	*	27	C	North Elevation - Doorway infill
6.5	22	10.2	28	I	East Elevation Plinth
6.5	22.2	10.5	29	I	East Elevation Plinth
6.5	22	10.7	28.5	I	East Elevation Plinth
5.9	22.4	10.5	28.6	I	East Elevation Plinth
6.4	22	10.5	28.9	Q	SE Turret Base
6.3	21.9	10.6	28.4	Q	SE Turret Base
6.6	22.4	10.9	29.1	Q	SE Turret Base
6.8	22.6	10.1	29.2	Q	SE Turret Base

Alison Kelly
May-08

APPENDIX VII BASE COURT CHRONOLOGY

This chronology forms Appendix I of 'Base Court - Interim Statement of Significance' by Kent Rawlinson (Curator of Buildings, Hampton Court Palace) and is included here for reference purposes.

Interim Statement of Significance (Version 1)
Base & Clock Courts

Appendix 1
Chronology

Period 1: Medieval (to 1514)	
*c*1237 – mid-15th century	**Base Court:** The area upon which Base Court stands may have served as part of the grange of the Knights Hospitaller. A medieval range probably stood on the site of the B.C. Courts Range.
*c*1479	**Astronomical Clock:** Casting of the bell now in the A.B. Gatehouse in Thomas Harrys' foundry. It is marked T.H. This is probably one of two bells recorded in an inventory of Hampton Court undertaken in 1495. [ST, 7]
Mid-late 15th century	**Base Court:** Building (or rebuilding) of the western range of the medieval grange or courtyard house for either John Wode or Giles Daubeney (probably the later). This range may have incorporated a tower or gatehouse. [ST, 9-10] A moat was dug to the west of this domestic range, i.e. in the area immediately to the west of the current B.C. Courts Range. The area to the west of this moat, present-day Base Court, may have been brought into domestic or residential use at this time. [See ST, 17; also fn. 20]
Period 2: 1514 – 1529 (Wolsey)	
1514-16	**Base Court:** Wolsey appears to have begun the construction of Base Court immediately upon the acquisition of Hampton Court. Infilling of western (and probably southern) arm of the earlier medieval moat immediately to the west of the W. range of medieval manor or grange. [ST, 12, 26] Demolition of the w. range of the medieval manor, except for a short section at its s. end which was incorporated into Wolsey's new range. The new moat to the w. of Base Court and the Great Gatehouse was probably dug in 1516, when £35 19*s* and 2*d* was spent on the digging of the 'new ditch'. [Harvey, 53]
*c*1514-*c*1521	**Base Court:** Construction of four two-storied ranges around Base Court and of two gatehouses: the Great Gatehouse (of five principal storeys) and the Anne Boleyn Gatehouse (of three-

	four principal storeys). Timber cut, moulded and prefabricated at 'Barwyn Wood' [ST, 20; E36/235, ff. 740, 826] Bricks manufactured on site by Richard Recolver. [ST, 20; E36/236, f. 835] Possible reuse of a large twelve-light window from the earlier medieval range (Room PF049).
1520, Autumn	**Base Court:** The London Merchant, Richard Gresham, was commissioned to furnish rooms at Hampton Court with tapestries; he visits to measure up 18 rooms.
*c*1521 or soon after	**Anne Boleyn Gatehouse:** The 'Wolsey Coat of Arms' was mounted immediately above archway on the gatehouse's eastern fa ade. This remains *in situ*.
1521, December	**Base Court:** First batch of tapestries for the furnishing of Base Court arrived. [ST, 26; TC, 77-83]
1522, April	**Base Court:** Base Court completed and hung with tapestries: in preparation for the visit of Charles V. Second batch of tapestries arrived; together both batches totalled 136 large tapestries and 43 window pieces, enough to furnish 22 lodgings. [ST, 26; TC, 123-5]
*c*1526	**Clock Court:** The (so-called) Wolsey Rooms abutting and adjoining the S.E. corner of Base Court. [ST, 31]
c 1526-9	**Base-Clock Courts Range (Western fa ade):** A stair turret built against the W. fa ade of the Baser-Clock Courts Range, to provide access to the first-floor chambers in the S.E. corner of Base Court and to the Wolsey Rooms. [ST, 31]
Period 3: 1529 – 1547 (Henry)	
1529, April	**Base-Clock Courts Range (Western fa ade):** Initial construction of a three-storey Buttery in the N.E. corner of Base Court. It is not clear when this work was completed. Construction of Houses of Offices outside Base Court, i.e. in 'Outer Green Court'.
1530-1	Minor repairs to lodgings etc. in Base Court. **Base-Clock Courts Range (Western fa ade):** These repairs may be associated with the apparent introduction/repair of a ground-floor window at far S. of range (Room GF073E) [Brick Typology: Types A&C]
1531, 7 May – 25	**Anne Boleyn Gatehouse:**

June	Royal arms in painted ironwork set up over Wolsey's terracotta arms on the E. fa ade of the A.B. Gatehouse.
1531, 15 October – 11 November	**Anne Boleyn Gatehouse:** Royal arms set up in painted stone on the W. and E. facades of the Great Gatehouse and upon the E. elevation of the western fa ade of A.B. Gatehouse.
1530-32	**Base-Clock Courts Range (Eastern fa ade):** Possible date of the demolition of the medieval (or early-16th century) S. range of Clock Court. At the point where this returned against the B.C. Courts Range two large chimney shafts were inserted. [ST2, 9] A doorway between the ground-floor of the B.C. Courts Range (Room GF973F) and Clock Court was probably blocked at this date. [Brick Typology: Types A&C]
1532-6	Construction of the Great Hall in its present form.
*c*1536	**Base-Clock Courts Range:** Insertion of the great staircase into the pre-existing range linking the A.B. Gatehouse and the Buttery. **Anne Boleyn Gatehouse:** Insertion of new stone fan-vault in archway of A.B. Gatehouse. 'The Northern part of the east side of Base Court had to be substantially remodelled. This included reconstructing the north flank of the Anne Boleyn Gate. Wolsey's vault was removed and a new fan vault installed bearing the initials of Henry and Anne.' [ST,20,51]
1535, February – 1537, February	**Base Court Surfaces:** Paving of 'Inner Court' [Clock Court] with 'Harde Raygg' or 'harde Stone pavyng'. building of Moat Bridge and pavying, with pebbles, of Base Court.
1535, September – 1536, February	**Base Court Surfaces:** Large pebbles collected and transported to Hampton Court for paving Base Court.
1535, September	Beginning of works on the foundations and stonework of the new stone moat bridge.
1536, 26 February – 25 March	**Base Court Surfaces:** Base Court and the completed stone moat bridge paved with large pebbles.
1539, 5 February	**Astronomical Clock:** Clock designed, probably by the Bavarian Nicolaus Kratzer, Henry VIII's Astronomer Royal and 'Devisor of the King's Horologes'. [ST,72; H,XIX]
1540	**Astronomical Clock:** Clock constructed and installed by Nicholas Oursian, whose initials (N.O.) and the date (1540) are inscribed in existing

	elements of the mechanism. [ST,72] This work must have necessitated the substantial remodelling of the upper-third of the A.B. Gatehouse.
*c*1530-40	**Astronomical Clock:** Two bells cast by William Culverden. These remain as part of the striking mechanism of the clock. [ST,73; but unreferenced]
1538-47 (probably late 1542)	**Base-Clock Courts Range:** Probable date at which the s. end of the B.C. Courts range was partly heightened, to enable the creation of better appointed lodgings, probably for Princess Mary's use. [ST,74] A substantial staircase turret is built against inner fa ade of the s. range of Base Court to provide improved access to these lodgings. [Thurley (1998), 38-41]
Period 4: 1547 – 1603 (Late-Tudor)	
1567-70	**Astronomical Clock:** Repairs to mechanism [H,XIX]
1584-5	**Astronomical Clock:** Repainting of both dials by George Gower, sergeant-painter. [E 351/3219; H,XIX]
1591-2	**Astronomical Clock:** Cleaning and mending of great dial. [E 351/3226; H,XIX]
Period 5: 1603 – 1689 (Stuart)	
1619, 1 October – 1620, 20 September	**Astronomical Clock:** Repainting of both dials by John de Creete. [E 351/3253; H,XIX; ST,109]
1647, 1 April – 1648, 31 March	**Astronomical Clock:** The mechanism of the clock repaired and partly replaced by Richard Nurse, Charles I's clockmaker. [AO, 1/2431/79; HXIX; ST,73]
1653, prior to	**Base Court Surfaces:** Base Court becomes mossy and over-grown (or is possibly turfed) during this period. It is described as, 'one other greene court', in 1653.
1664, October	**Astronomical Clock:** Repainting of both dials by Robert Streeter. [WORK 5/6; E351/3278; H,XIX]
1666, August – 1667, May	**Great Gatehouse:** N.W. tower of the Great Gatehouse carefully rebuilt. Much the n.w. part of the Gatehouse rebuilt, including the porter's lodge. A pedestrian entrance was created. [ST,146]
[pre-1674]	**Base-Clock Courts Range:**

	Third floor-lodging between the Anne Boleyn Gatehouse and the Great Hall/Buttery, over the Great Stairs, are created (or remodelled), probably by (or for) Mr. East, the clock maker. **Base-Clock Courts Range (Western fa ade):** Insertion of a pair of casement windows in third-floor of range to the n. of A.B. Gatehouse. **Base-Clock Courts Range (Eastern fa ade):** Insertion of a pair of casement windows in third-floor of range to the n. of A.B. Gatehouse. [Brick Typology: Type E (late 16 to early 17 century)]
1679, July	**Astronomical Clock:** Carpenters mending the frame of the clock. [WORK 5/32; H,XIX]
1680-1	**Astronomical Clock:** Repairs to dial of the clock by Henry Wynne. [E 351/3294; H,XIX]
Period 6: 1689 – 1714 (William & Mary; Anne)	
*c*1690-1	**Base-Clock Courts Range (Eastern fa ade):** Infilling of half of an eight-light window to accommodate Wren's colonnade. [Brick Typology: Types I (Wren, late 17 to early 18 century)]
1699-1700	**Astronomical Clock:** Basic maintenance of clock by Thomas Herbert. [AO 1/2446/138; H,XIX]
1699-1700	**Base Court Surfaces:** Repaving of Base Court, 'part of which must be done that ye King's coach may come well into the ffountaine Court'. Paving undertaken with 'square paveing', 'ragg paveing' and (perhaps) pebbles.
1700, April	**Astronomical Clock:** Minor repairs to the timber frame of the clock? [WORK 5/51; H,XIX]
1700, July	**Astronomical Clock:** A new handle to wind the clock. [WORK 5/51; H,XIX]
1700, August	**Astronomical Clock:** Alteration of hand of the clock by Thomas Hebert. [WORK 5/51; H,XIX]
1701, prior to	**Base-Clock Courts Range (Western fa ade):** Bricking-up of s. Buttery doorway and insertion of casement window. Refacing of brick plinth seemingly along the length of the range. Blocking of the doorway between Base Court and the ground-floor of the east range of Base Court (Room

	GF075). The stone dressing of the door retained until *c*1840. **Base-Clock Courts Range (Eastern fa ade):** Refacing of brick plinth along most of the length of the range. [Brick Typology: Types H & I (Wren, late 17 to early 18 century)]
	Base-Clock Courts Range (Eastern fa ade): Refacing/rebuilding of upper section of the staircase turret at the s end of the Base Court East Range. [Brick Typology: Types H & I (Wren, late late 17 to early 18 century)]
1702, September	**Astronomical Clock:** Thomas Herbert, 'watchmaker', paid for 'making all new the watch part of the great Clock'. [WORK 5/53; H,XIX; ST,215]
1707, January – December	**Astronomical Clock:** Repairs to the clock by Mansel Bennett, 'clockmaker'. [H,XIX]
1707, 28 August	**Anne Boleyn Gatehouse:** Wren proposes substantial remodelling of the upper-part of the A.B. Gatehouse, considered 'in danger of falling'. Proposed works included: taking down parts of the 'old Turrett', rebuilding this with new bricks; reconstructing the tops of the turrets, centralising the clock and bells, making a new cupola, and re-leading the roof. [WORK 6/14; H,XIX; ST,20,215]
1710-1711	**Astronomical Clock:** Clockmaker Langley Bradley, of Fenchurch Street, commissioned to replace the mechanism of the clock, with an eight-day quarter clock. He retains the bar with Oursian's 'N.O.' signature. [WORK 6/5; H,XIX; ST,215]
Period 7: 1714 – c 1760 (Georgian Royal Palace)	
[pre-1718]	**Base-Clock Courts Range (Eastern fa ade):** Construction of a single-storey crenulated porch immediately to the s. of the A.B. Gatehouse. This provided internal communication between the ground-floor of this range (Room GF075B) and the n.e. turret of the gatehouse. [See Historic View 26]
1719	**Astronomical Clock:** Terms agreed for the 'Labourer in Trust' paid for cleaning and winding the clock.
1721, May	**Astronomical Clock:** Astronomical Clock: John Davis of Windsor, 'undertook another major overhaul of the clock'. [ST, 419, n.23]
1721, 11 July	**Astronomical Clock:** Repairs required to the clock. [WORK 4/2; H,XIX]

1732, January – December	**Astronomical Clock:** Repairs to the clock mechanism by Charles Clay. [AO 1/2454/166; H,XIX]
Period 8: c 1760 – c 1838 (Grace & Favour Palace)	
1785, Lady Day	**Astronomical Clock:** Reinforcement of clock structure. [WORK 5/74]
1794, Christmas	**Astronomical Clock:** Repainting of the dial(s) of the clock and the surrounding stone frame (with gilding and with stone-coloured paint) by Elizabeth Betts. [WORK 5/83; H,XIX]
1795, Midsummer	**Astronomical Clock:** Cleaning and repairing of the stone frame of the clock by John Vilder. [WORK 5/84; H,XIX]
1795, Christmas	**Anne Boleyn Gatehouse:** The ball on the cupola above the gatehouse gilded. [WORK 5/84; H,XIX]
1799	**Astronomical Clock:** Manufacture of a clock for St. James's Palace by B.L. Vulliamy. This clock was moved to Hampton Court palace in 1835. [Law, III, 344-5].
1809, Lady Day	**Anne Boleyn Gatehouse:** The cupola above the gatehouse painted. [WORK 5/98; H,XIX]
1821	**Base-Clock Courts Range (Western fa ade):** A.C. Pugin produced a measured drawing of the vaulting beneath the 'Middle Gate', bearing the initials of Henry VIII and Anne Boleyn. [ST, 303; Historic Views 8-10]
1819-1826	**Base-Clock Courts Range (Western fa ade):** At some point between 1819 and 1826 [Pyne; Historic View 12] the 16th-chimney stack above the w. fa ade of the Buttery was removed.
1835, October	**Astronomical Clock:** The broken mechanism replaced with another made for St. Jame's Palace in 1799, by B.L. Vulliamy. [ST, 303] The Base Court dial is replaced with 'a tablet bearing William IV's monogram' and the slate clock face from St. James's Palace. [ST, 303] The St. James's mechanism does not work and was removed, 'some years later... the space it had occupied being filled with black painted boards' [Law, III, 364; ST,303] The great dial of the clock appears to have been removed around this time, it may have passed into the possession of B.L. Vulliamy, and Law states it was in store in 1879. [Law, III, 386; H,XIX]
Period 9: c 1838 – 1912 (Public Palace)	

1839, 21 October	**Astronomical Clock:** B.L. Vulliamy proposed a complete overhaul of the clock mechanism, 'not having been cleaned since it was put up in October 1835'. 'The copper faces forming the front of the dial are much perished'. [WORK 19/525; H,XIX]
	Base-Clock Courts Range [General repair and renewal of window and door dressings?]
[post-1840?]	**Base-Clock Courts Range (Western fa ade):** Removal of the stone dressing of the doorway between Base Court and the ground-floor the Base Court East Range (Room GF075). This doorway is blocked and the plinth continued across it at ground level. [Brick Typology: Type Q (late 18 to 19 century)]
[This phase?]	**Base-Clock Courts Range (Western fa ade):** Minor renewal of stone dressings and brickwork associated with the 16th-century two-light ground-floor window to the n. of the Buttery doorway (Room GF291). [Brick Typology: Types Q (late 18 to 19 century)]
[*c* 1830?]	**Anne Boleyn Gatehouse:** Demolition of the 18th-century porch to s. of the A.B. Gatehouse. The doorway between this porch and the ground-floor of the range (Room GF075B) was blocked and the dressing of the doorway into the s.e. turret of the A.B. Gatehouse were renewed. [Brick Typology: Sheet 22]
[This phase or earlier?]	**Base-Clock Courts Range (Eastern fa ade):** Renewal of southernmost flue and chimney stack. Substantial rebuilding and enlargement of the middle flue and introducing four chimney stacks. The lower parts of both these flues are Henrician. [See above 1530-32] Introduction of the northernmost single flue and chimney stack. A further flue, with a stump stack was introduced at the time date, but was removed post 1930. [Brick Typology: Sheet 22] A short stretch of the third-floor (above the Wren colonnade) completely rebuilt. [Seeming renewal of most stone window dressings? – throughout?] Renewal of dressing to the doorway between the ground-floor of the range (Room GF075B) and Clock Court. Renewal of the brickwork plinth of the range n. of the A.B. Gatehouse. [Brick Typology: Type T (19 century)]
1847	Restoration of 'the roof on the north side of Base Court'. [ST, 299]
1851, 20 October	**Astronomical Clock:**

	Tender accepted from Mr. Dutton, clock maker, tenders for the repair, cleaning and winding of the clock. [WORK 1/38; H,XIX]
1856, 20 November	**Astronomical Clock:** The beam which carried the 'Quarter Bell' examined and found to be sound. [WORK 1/69; H,XIX]
1879	**Astronomical Clock:** A new mechanism commissioned from Gillett and Bland of Croydon, clockmakers and bell founders. [WORK 19/525; H,XIX] This was reported to working well in July 1880. [H,XIX]
1880	**Anne Boleyn Gatehouse:** Decision to undertake restoration the AB Gatehouse. [ST,303]. John Lessels decides to replace vault beneath the gatehouse with a close copy (this remains *in situ*). [ST,303]. Interior of the archway of the A.B. Gatehouse refaced with red face bricks. **Base-Clock Courts Range (Western fa ade):** Lower exterior facades of the n.w. turret of the A.B. Gatehouse refaced with red face bricks. Small areas beneath the windows of the Great Stair (GF282A) and areas of the plinth refaced with red face bricks. [Also in this phase?] Two 'Tudoresque' paired chimney stacks inserted to both the n. and s. of the A.B. Gatehouse. A single simpler stack inserted abutting the n.w. turret of the gatehouse. [Brick Typology: Type T (19 century)]
1891, August - September	**Base Court Surfaces:** Correspondence between Lessels and Ponsonby-[Fane] concerning the proposed resurfacing of Base Court. A scheme is approved. [See Appendix 4: National Archives WORK 19/13/7]
1891-2, Winter	**Base Court Surfaces:** Partial returfing of Base Court as proposed in August-September 1891. The proposed cross path may never have been introduced.
[Late-19th to early-20th Century]	**Base-Clock Courts Range (Western fa ade):** Refacing/rebuilding of Buttery parapet and n.w. turret of the A.B. Gatehouse with stock bricks (above the level of the string course). [Renewal of stone copings to parapets?] Refacing of much of n.w. and s.w. turrets of the A.B. Gatehouse with stock bricks. Refacing of parapets to ranges s of A.B. Gatehouse and to the s staircase turret. [Brick Typology: Type V (19 to 20 century)]

Period 10: 1912 – 1986 (20th Century Palace)	
1918, 1 October	**Astronomical Clock:** The mechanism of the St. James's Palace clock reported to be kept in a box in the 'old Kitchen'. [H,XIX]
1923	**Archaeology:** Partial excavation revealed 'fragments of wall' in the 'east area' of Base Court] [Appendix 5: *Preliminary Archaeological and Historical Appraisal*]
1937	**Astronomical Clock:** Request that the 15th-century bell be 'returned' to the Knights Hospitallers. This request is refused. [WORK 19/1008; H,IX]
1947	**Astronomical Clock:** Astronomical Clock: Overhaul by Thwaites and Reed of Clerkenwell. [ST,426,n.60]
1959-60	**Astronomical Clock:** Astronomical Clock: Further overhaul by Thwaites and Reed of Clerkenwell. [ST,426,n.60]
[1960s?]	**Anne Boleyn Gatehouse:** Significant structural repairs/stabilisation of the uppermost stages of the gatehouse? [This phase of works appears very poorly recorded.]
1966-7	**Archaeology:** Excavation of Daubeney's s. range in Clock Court, by Peter Curnow and Alan Cook.
1971	**Archaeology:** Archaeologial excavation of Base Court Moat ditch, under Tony Pacito. [ST,431,n.13; A report of this investigation does not appear to have been produced.]
1973-4	**Archaeology:** Second excavation of Daubeney's s. range in Clock Court, under John Dent and Brian Davidson.
1976, May	**Archaeology:** Archaeological excavation of area beneath(?) the Wolsey Suite by the Inner London Excavation Unit under David Whipp. [ST,403,n.79]
1977	**Archaeology:** Archaeological excavation of the W range of Clock Court, under Tedd Higgenbottom. [ST,403,n.79] Archaeological investigations in Apt. 36 (current Base Court Shop) confirmed course of early moat, revetment wall and possible water gate (to the s. of the Anne Boleyn Gateway). [Appendix 5: *Preliminary Archaeological and Historical Appraisal*]
[1970s]	**Archaeology:**

	Small excavation in Base Court, by John Dent and Brian Davidson, revealed the early phase(s) of the medieval moat. [ST,359]
[1970s]	**Base Court South Range:** Parapets on the s. range of Base Court rebuilt, under the P.S.A. (using 'mass-produced replica Tudor bricks'). [ST,376]
1979	**Base-Clock Courts Range:** Stripping out and refitting of rooms in E range of Base Court to create Base Court Shop. This revealed: The garderobe shafts of Daubeney's house. Fragment(s) of Elizabethan wallpaper. [ST,378]
1979, 12 June	**Base Court Surfaces:** Date of Gerald Heath's letter to Juliet Allan re. Base Court reseach.
1980	**Base Court South Range:** Work began on creation of Renaissance Picture Gallery in Base Court (Apts. 19 & 20) (enabling works including the insertion of an air-conditioning plant and the strengthening of the 16th-century floor structure). [ST,374]
[This phase]	**Base-Clock Courts Range (Western fa ade):** Refacing of sections of the brick plinth. Refacing the lower part of the chimney stack immediately to the n of the AB Gatehouse. **Base-Clock Courts Range (Eastern fa ade):** Refacing of part of the upper fact of n.e. turret of the A.B. Gatehouse. [Brick Typology: Types Modern]
Period 11: 1986 – Present (Modern Palace)	
[1990/91?]	**Archaeology:** Trial archaeology and geophysical survey undertaken in Base Court to identify evidence of historic surfaces. [Appendix 5: *Preliminary Archaeological and Historical Appraisal*]
1991	**Base-Clock Courts Range (Western fa ade):** Brickwork conservation project on the staircase turret at the s. end of the range. [P.S.A. RRP/2002/232/C; RPG/2002/374B]
1991, 6 December	**Archaeology:** Simon Thurley sent a 'Preliminary Archaeological and Historical Appraisal. Base Court. Hampton Court Palace' to English Heritage (Sophia Andreae). HRPA hoped to begin 'events' the next year. [Appendix 5: *Preliminary Archaeological and Historical Appraisal*]

1991-2	**Base Court Surfaces:** H.R.P.A. produce, and are granted consent for, a scheme to recobble Base Court.