The JESSOP Consultancy

Sheffield + Lichfield + Oxford

MARBLE HALL FLOORING,
KEDLESTON HALL, DERBYSHIRE

Historic Fabric Survey
on behalf of the National Trust

March 2017

Document No: TJC2017.03
Planning Application No: n/a
OASIS No: thejesso1-276 708

Office contact details

The JESSOP Consultancy
The Old School House
6 Broad Elms Lane
Sheffield
South Yorkshire
S11 9RQ

Tel: 0114 287 0323

The JESSOP Consultancy
1 Sherbrook House
Swan Mews
Lichfield
Staffordshire
WS13 6TU

Tel: 01543 479 226

The JESSOP Consultancy
12 West View
Iffley
Oxford
Oxon
OX4 4EX

Tel: 01865 364 543

SUMMARY OF PROJECT DETAILS

OASIS ID:	Thejesso1-276 708
TJC Project Code:	MHK17
Project Type(s):	Historic Fabric Survey
National Grid Reference:	SK 31271 40296 (DE22 5JH)
County:	Derbyshire
District/Unitary Authority:	Amber Valley
Parish:	Kedleston
Elevation (above sea level):	c.88m
Designation Status(s):	Grade I Listed Building (NHLE: 1311507)
HER Record No(s):	Derbyshire 21901
NT HBSMR	62002 – MNA112448
Prepared by:	Oliver Jessop MCIfA David Watt (Illustrations)
Reviewed by	Manda Forster PhD MCIfA Giles Warhurst MRICS Rachael Hall MCIfA
Date:	March 2017
Version:	Final (29.03.17)

TABLE OF CONTENTS

NON-TECHNICAL SUMMARY

The archaeological survey of the floor structure of the Marble Hall at Kedleston has included archive research, a measured survey and digital photography. It has been undertaken to compliment a suite of investigative surveys including laser scanning, structural monitoring, GPR survey and a programme of mortar analysis. Whilst only a relatively small area of the floor structure has been available for examination it has been possible to establish the nature of its construction, along with a possible explanation for the cracking of the marble paving.

The floor is a double joist construction, which was typical of 18th century floors where wide spans were required, or heavy loading was a considered important. The floor is essentially supported on pairs of massive principal joists that are 0.47m in depth and c.10m in length located between the columns along the west and east sides of the hall. There are still however, aspects of the floor structure that are not fully understood. In particular whether the principal floor beams are trussed in any form and whether they actually span the full width of the Marble Hall. Spanning between the principal beams are upper and lower joists, that in turn support secondary joists for the ceiling of Caesars Hall below.

The weight of the floor was considerable and this is likely to have had a direct impact upon the deflection across the whole span of the room. In regards to the localised cracking that has occurred around the edge of a number of the marble paving slabs, it is suggested that this is partly due to movement within the sand matrix that supports them. The gradual loss of sand between the joints in the timber planks would account for a slight change in the density of the layer beneath the paving, and it has been noted that many of the mortared brick foundations beneath the principal decorative elements of the floor, such as the petals, roundels, or circular motifs are slightly undercut from the outer edge of the surface paving. It is therefore suggested that in areas where the sand sub-floor has moved, or if high pressure has been applied to the edge of the paving, the stone appear to have cracked along the edge of the undercut foundation below, although these findings should be considered in conjunction with the results of the other investigative surveys that have been undertaken.

In addition, the survey has identified the impression of heel (boot/shoe) prints within the mortar torching that was smeared across the joints in the floor planks to prevent the sand from the sub-floor from dropping down to the ceiling void above Caesars Hall. The date of the mortar appears to be an integral aspect of the original floor construction, and is therefore dated to the c.1760-65.

This programme of recording was targeted, focusing on a series of small areas where the historic fabric of the floor was exposed. Despite this, it has demonstrated the huge potential for gaining new evidence regarding the construction of the building. Any future works should be undertaken with appropriate archaeological supervision.

The site archive has been deposited with the National Trust at Kedleston and the report uploaded to the OASIS (Online AccesS to the Index of archaeological investigationS) digital archive with the reference number: ***thejesso1-276 708****. Additional copies of the report have been distributed to the National Trust and the Derbyshire Historic Environment Record.*

Recommendations

1. *Once the analysis of the mortar and sand has been completed by Cliveden Conservation, the interpretations made within this report should be re-examined to ensure that any variation in fabric can be interpreted in light of the new results;*

2. *Once the results of any further archive research in undertaken, the conclusions of this report should be reappraised in light of any new evidence;*

3. *Should any further floor slabs be lifted for repair it is recommended that this should be undertaken with archaeological supervision to ensure that any new details concerning the construction of the floor can be documented;*

4. *The results of this recording exercise should be considered alongside the results of the structural survey and GPR survey, following which a rapid survey of the areas of cracking within the paving should then be undertaken to confirm whether it is mainly associated with areas where undercut foundations are understood to exist;*

5. *The opportunity should be taken to examine the floor from below in Caesars Hall. This would involve minimal intervention into lath and plaster ceiling, but could provide a much greater understanding of specific details regarding the construction and physical condition of the floor;*

6. *The observations made during this programme of fieldwork are considered to contribute to our understanding of the construction of Kedleston Hall, and the discovery of bootprints from c.1760s should be considered as highly significant. It is recommended that the results are published in a suitable journal such as the Georgian Group, or with the Derbyshire Archaeology Society.*

1 INTRODUCTION

BACKGROUND

This document presents the results of an historic fabric survey of the floor structure beneath the Marble Hall at Keddleston Hall, Derbyshire (**Figure 1**). It is one element of a programme of investigation examining the construction of the floor and damage it has historically suffered from structural movement including the cracking of the paving and a deflection in the floor surface.

The building is a Grade I Listed Building (NHLE: 1311507). It is owned and managed by the National Trust (hereafter NT).

AIMS

The primary aim of this archaeological survey has been to survey, identify and interpret the exposed sections of flooring within the Marble Hall. In particular details of the jointing and timber structure upon which the paving has been laid.

A secondary aim has been to establish the mortar composition of the different structural phases of the floor which can be used to guide the repair programme. The analysis of the samples is being undertaken by Cliveden Conservation, the results of which will be presented in a separate report.

PRINCIPAL DELIVERABLES DERIVING FROM THIS WORK:

- To produce a drawings of the floor structure enhanced with archaeological information;
- To establish the constructional sequence of the extant historic fabric;
- To produce a series of digital photographs of the exposed historic fabric;
- The preparation of an interpretative report;
- To take mortar samples from each structural phase.

DISSEMINATION

Copies of this report will be distributed to the NT, the Derbyshire Historic Environment Record (HER), and a digital copy will be uploaded to the OASIS (Online AccesS to the Index of archaeological investigationS) with the reference number: **thejesso1-278 708**.

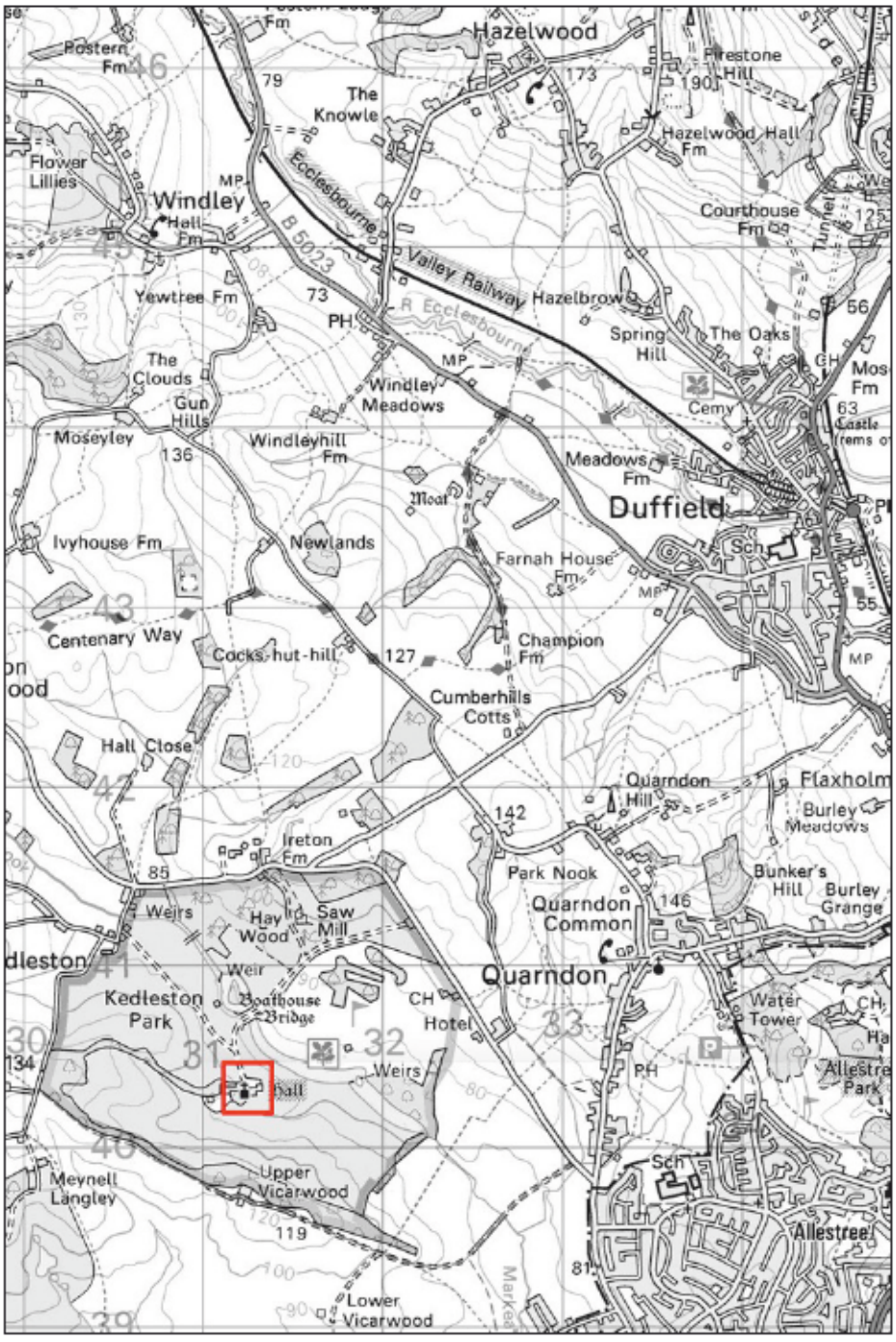


Figure 1: Location of the site

2 SITE LOCATION AND BASELINE CONDITION

Location of Site and Setting

The Marble Hall is located in the central block that comprises Kedleston Hall, on the north side of the building (**Figure 2**). It is at first floor level, forming part of the suite of rooms that comprise the piano nobile, or principal floor of the Hall. Immediately below the Marble Hall is a lower hall, 'Caesars Hall', that has direct access to the external courtyard

Kedleston Hall is located at NGR: SK 31271 40296 in central Derbyshire (**Figure 1**).

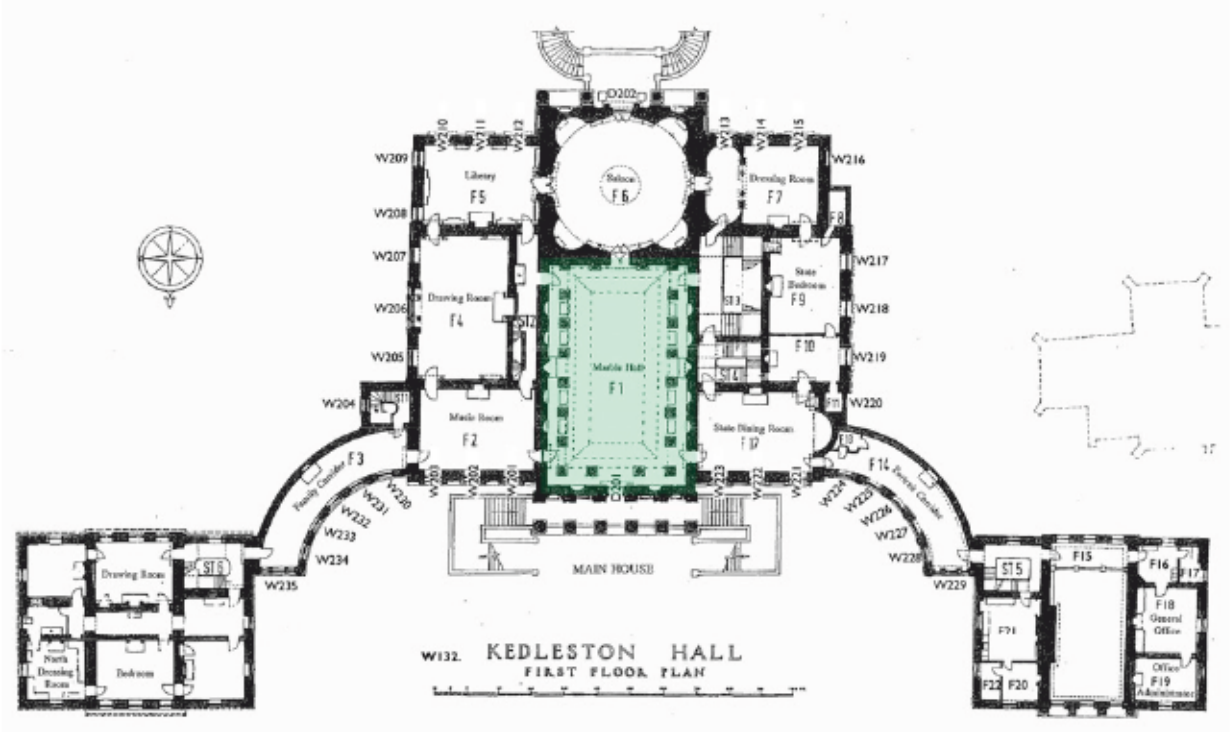


Figure 2: Plan of Kedleston Hall with location of the Marble Hall highlighted in green

Plan provided by the National Trust ©

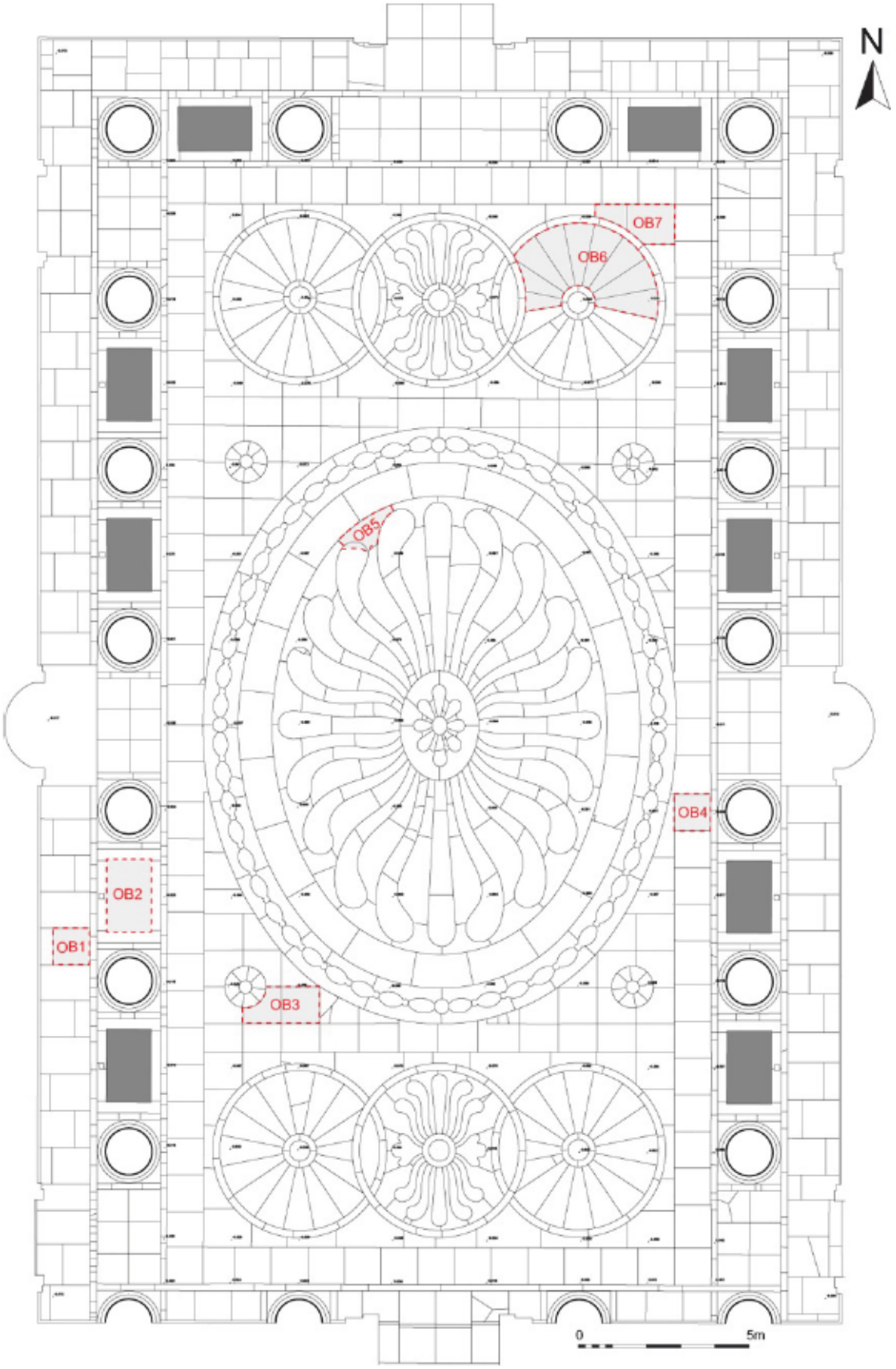


Figure 3: Floor plan of the Marble Hall with locations of archaeological observations

Base survey provided by James Brennan Associates/National Trust ©

3 METHODOLOGY

Introduction

This archaeological building survey has been prepared in accordance with a guidance prepared the Chartered Institute for Archaeologists (CIfA 2014) and Historic England (HE 2016). The project methodology has comprised of a series of stages, including a rapid review of previous work, a site survey, photography and mortar analysis.

The survey has been undertaken with reference to an outline scope of works detailed by Rachael Hall and Giles Warhurst of the NT.

Limitations

The archaeological survey has examined all readily accessible areas of the floor within the Marble Hall, although no direct access was possible into the lower floor void. All photographs and measurement within this part of the floor structure have been taken through narrow gaps in the floor planking c.1cm in width.

The scope of the report is limited to:

- Consultation with architectural plans produced for the building;
- Review of relevant archive and documentary material available at the time of survey;
- Detailed site survey comprising of measured drawing and photography;
- Sampling and analysis of mortar (to be reported upon by Cliveden Conservation);
- The preparation of this report and a fieldwork archive.

Nomenclature

The terminology used throughout this document has been derived from existing names and descriptions associated with the Kedleston Hall. It should be noted that future research may identify additional descriptions for specific aspects of the building and its floor structure.

Site Survey

Following careful cleaning of the exposed sections of flooring, a detailed measured and photographic survey (see **Appendix 3**) has been undertaken of the floor structure. The drawings are reproduced as **Figure 11-13** and a selection of the digital photographs as **Appendices 2.1-2.31**. The site was inspected by Oliver Jessop MCIfA on the 13th, 17th and 18th January 2017.

4 UNDERSTANDING THE SITE – HISTORY

Introduction

This section of the report presents a summary history of the construction of Kedleston Hall. It has made reference to the previous historical published and archive sources (see bibliography). Relevant visual sources are included as **Appendix 1**.

Kedleston Hall

In 1758 Nathaniel Curzon commenced planning a new house at Kedleston and began discussions with the architect Robert Adam. James Paine was then commissioned to begin work on the kitchen pavilion and quadrant corridors, but it was Adam who oversaw the construction of the main block from 1760, with the foundations being laid in 1762. The main phase of building appears to have been completed by 1768, although the interiors were not finished until 1789.

The Marble Hall

The Marble Hall forms a central structural element of the main block and the core fabric will have been executed to the design of Robert Adam. The Alabaster columns were erected in the hall in 1763, the skylights installed in 1764, however it was not until 1775–78 that the Marble Hall was completed to designs by George Richardson.

5 UNDERSTANDING THE SITE – HISTORIC FABRIC

Introduction

This section of the report presents the results of the archaeological survey and analysis of the exposed historic fabric that forms the floor of the Marble Hall. Seven individual areas were examined (OB1-OB7) (**Figure 3**), each of which is described in turn below (**Appendices 2.1, 2.2**) followed by a short discussion.

To accompany the written description a series of illustrative drawings have been prepared (**Figures 4-13**) and photographs of the various structural elements are included as **Appendix 2**.

It should be noted that access to the lower sections of the floor structure was only possible through very narrow gaps in the timber planks and around the edge of the floor heater in OB2. Care was taken to ensure that the measurements provided are as accurate as possible without having to open up large sections of flooring, thus minimising impact to the historic fabric.

The opening up of each section of floor and the removal of the sand sub-floor deposit was undertaken without archaeological supervision, although additional cleaning was included as part of the survey. The sand had been removed by a vacuum cleaner and bagged for sieving, washing and reuse. Finds recovered from the sand included a few pieces of rope/twine, small brick fragments and a nail — all this material has been returned to the NT at Kedleston.

The exposed sections of flooring within the Marble Hall have been backfilled, taking care not to damage any of the archaeological features that have been recorded, so that they can be re-exposed in the future should the need arise.

Description of Fabric

OB1 (NT ref: 2017–01R06)

A single floor slab measuring 0.58m x 0.58m had been lifted in the narrow aisle on the west side of the west colonnade (**Figure 3**). The paving slab (Hopton Wood Stone) was 3.2cm in thickness, with a slightly beveled edge containing traces of a white lime mortar/grout (**Figure 4**).

Beneath the paving slab was a layer of compacted pink mortar/sand (**Appendix 2.3**) 4.8cm in depth, and which overlay thick timber planks (**Appendix 2.4**). Three planks were exposed below the sand which were orientated west-east, measuring c.26cm in width, with a gap of 0.5–1cm between them.

No traces of mortar torching was observed covering the joints.

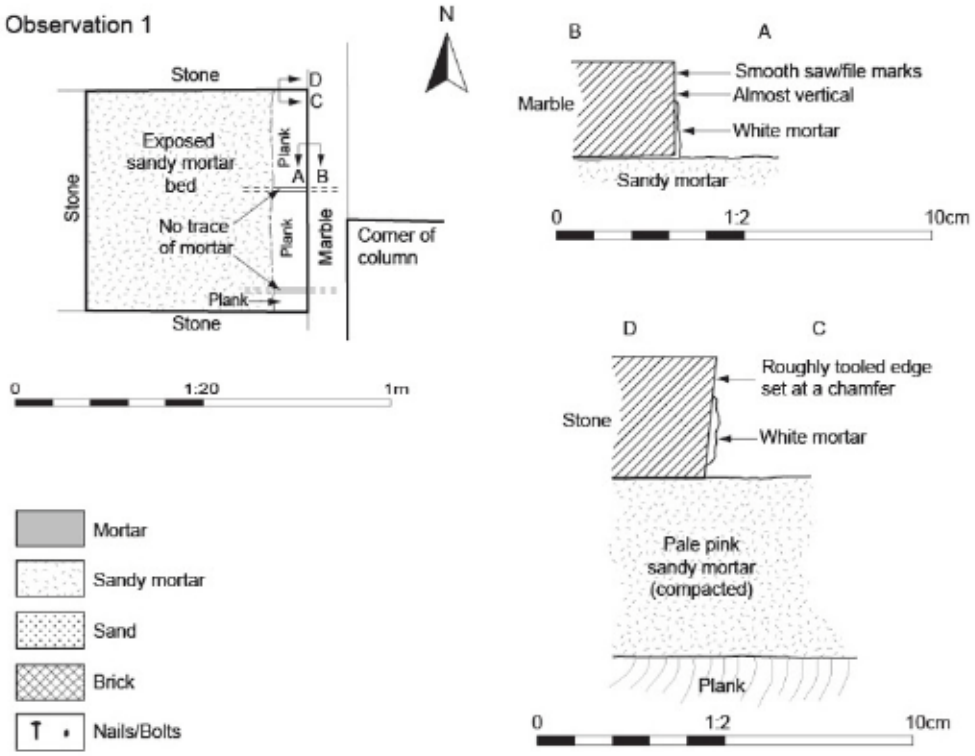


Figure 4: Plan with archaeological observations and cross-sections through OB1

OB2 (NT ref: n/a)

Following the removal of the metal grill (**Appendix 2.5**) above one of the floor heaters between the columns in the west colonnade (**Figure 3**), a narrow gap around the edge of the heating unit was revealed allowing the floor void to be observed (**Appendix 2.6**). The opening for the heater measured 0.62m x 1.08m (**Figure 5**), however an area of approximately was observed 0.96m x 1.4m below the floor.

The marble paving around the edge of the heater is up to 6cm in thickness (**Figure 5**), below which the floor void measures 42cm to the underside of the lath and plaster ceiling of Caesars Hall. The floor heaters are a secondary insertion into the floor of the Marble Hall, c.1910 in date, although whether existing large paving slabs were reworked, or new ones introduced into the room to take the opening for each heater is unclear. The heaters are supported on two inverted T shaped narrow rails/RSJs that are orientated north-south (**Appendix 2.6**) and apparently fixed into the stonework beneath each column.

Beneath the floor evidence that the heaters are secondary survives as a blocked recess in the rough stonework beneath the marble column to the north (**Appendix 2.7**). The former opening has been infilled with two fragments, but was presumably intended for a north–south floor joist.

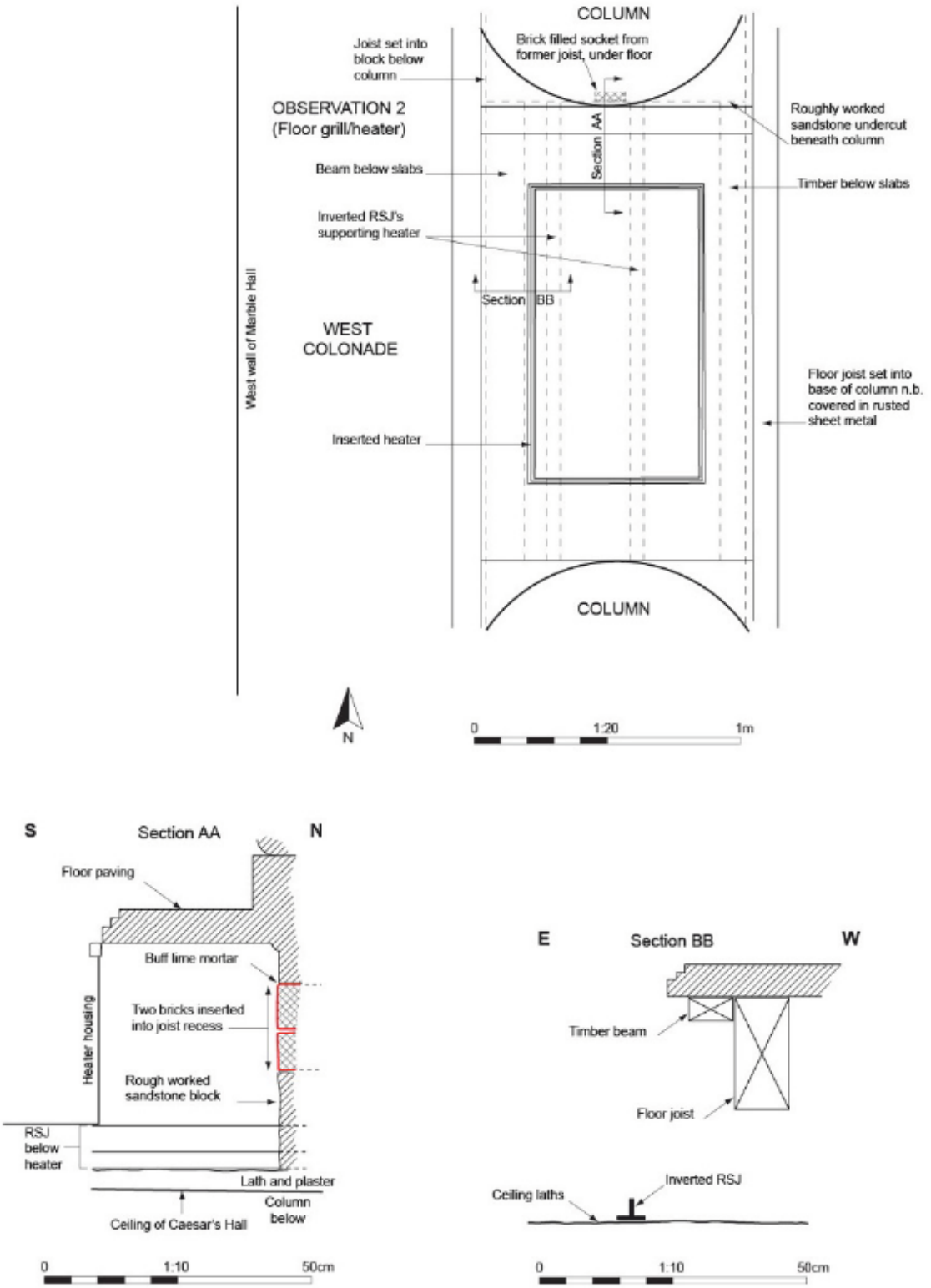


Figure 5: Plan with archaeological observations and cross-sections through OB2

OB3 (NT ref: 2017-01R05)

Two paving slabs measuring an area of c.0.58 x 1.24m (**Figure 3**) had been removed against the rounded edge of a decorative roundel in the southwest section of the floor (**Appendix 2.8**). The marble paving of the main floor slabs was 3.2cm in thickness, although the black and white veined marble used for the roundel was thicker at 3.5cm (**Appendix 2.13**). The paving had a slightly beveled edge and traces of white mortar/grout were noted still adhering in places.

Beneath the paving was a deposit of compacted yellow sand containing occasional small fragments of brick/tile (**Figure 7**). The sand was 10.5–11.5cm in thickness and overlay timber floor planks that were orientated west–east. The planks measured c.25cm in width, with a thickness of 4.5cm (**Figure 6**).

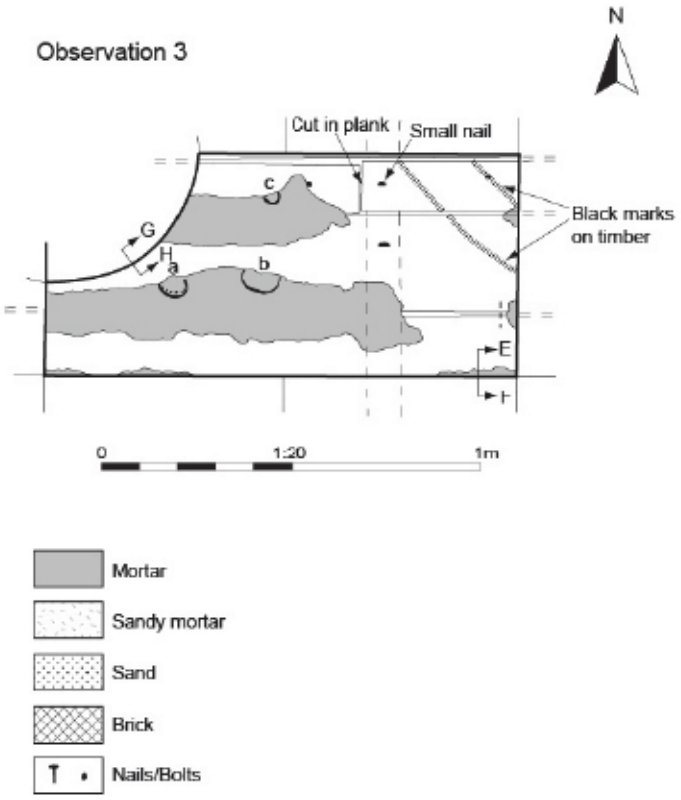


Figure 6: Plan with archaeological observations of OB3

The floor planks were supported on north–south joists (**Appendix 2.14**), with the principal floor beams running west–east spanning between column on either side of the room, a distance of c.10m. It has not been possible to establish whether these floor beams are trussed in any way, or have additional strengthening the centre to counteract the natural deflection in the floor once the weight of the sand had been added. The floor void measured 43cm to the underside of the floor planks, making a total thickness from the ceiling of Caesars Hall to the paving of the Marble Hall of 0.63–0.65m.

The planks were horizontally laid and secured to form a level upper surface with concealed timber dowels, c.1.2–1.4cm in diameter and at a depth of 1cm below the upper surface of each plank. The floor planks are also secured from above into each of the upper floor joists with pairs of nails (**Appendix 2.10**), one on each side of the plank.

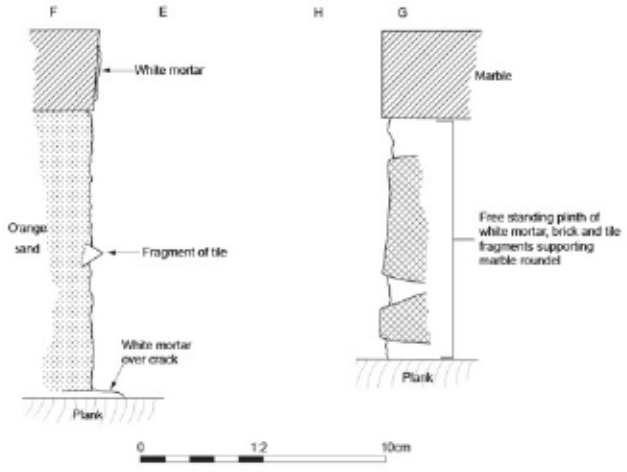


Figure 7: Cross-sections through OB3

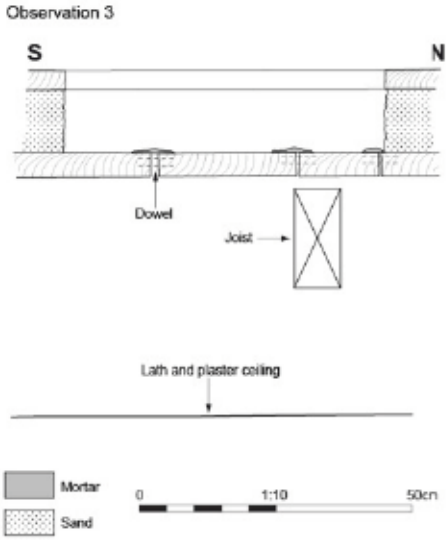


Figure 8: Cross-section (S-N) through OB3

Covering the joints between the floor planks was a layer of mortar torching, which was 12–16cm in width and c.1cm in thickness (**Appendix 2.11**). The purpose of this mortar was to prevent the sand from seeping down to the ceiling void below above Caesars Hall. The mortar continued beneath the brick and mortar foundation that supported the circular roundel (**Appendix 2.13**), indicating that the floor planks and mortar torching pre-dated the formation of these foundations. The foundation for the roundel was however, laid before the sand sub-floor was laid down.

Within the upper surface of the mortar torching a series of impressed arcs were noted (**Appendix 2.11**) and upon closer inspection were found to be the heel prints from hob-nailed boots (**Appendix 2.12**). A total of three distinct impressions were recorded 6.5cm, 7.5cm and 9cm, although this wider mark may have been stretched (**Figure 9**). Two of the impressions contained evidence for hob-nails, which were sub-rectangular in form and concentrated around the edge of the heel, or in its centre.

The bootprints would have been created when the plaster was still setting, and presumably indicates that the tradesmen were able to walk freely across the floor surface with no regard for the fact that the mortar was still wet.

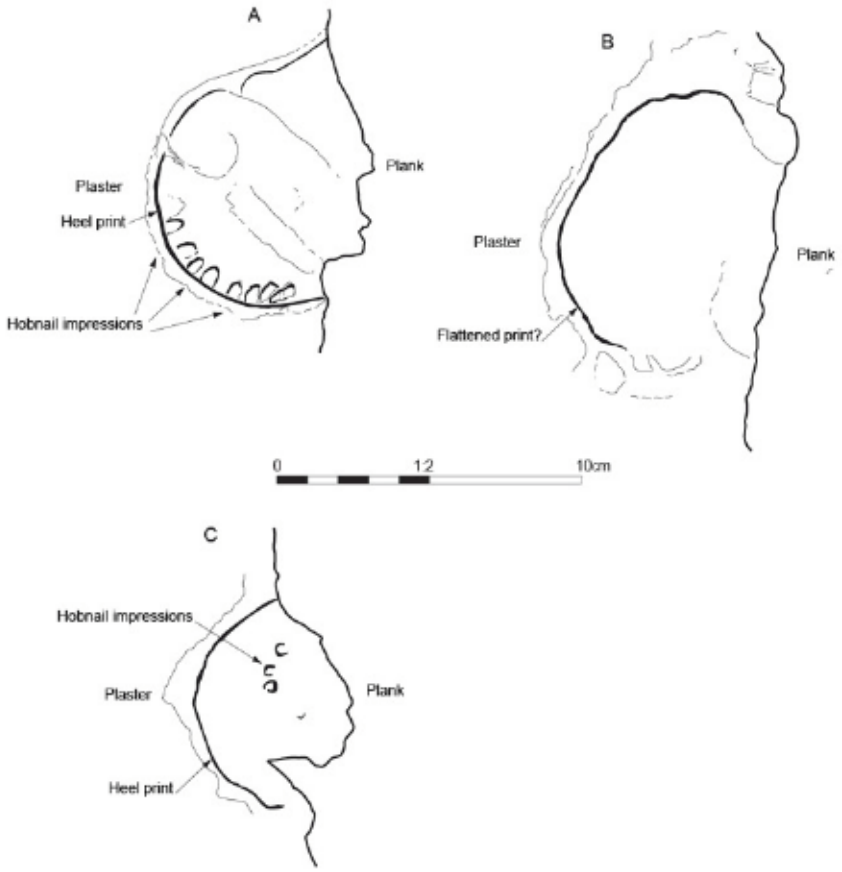


Figure 9: Plan with archaeological observations and cross-sections through OB4

The final feature that was recorded within OB3 consists of two curved painted lines in the northeast corner (**Appendix 2.9**). They were applied directly to the upper surface of the floor planks and measured 2cm in width and were 13cm apart (**Appendix 2.10**). The lines continue below the mortar torching right to the edges of the exposed planks and are interpreted as the setting out of a paving design prior to the mortar being laid. It is interesting to note that the painted arcs have no resemblance to the finished marble paving in this part of the room.

OB4 (NT ref: 2017–01R04)

A single floor slab measuring 0.58m x 0.58m was lifted against one of the columns (**Appendix 2.15**) along the eastern side of the room (**Figure 3**), a site where water had historically been leaking from the roof above. The marble slab was 3.5cm in thickness, with a slightly beveled edge (**Figure 10**). Following the removal of the sand sub-floor (**Appendix 2.16**), a series of sections of timber planks orientated west–east were exposed. The timbers were set at differing heights and represent a historical repair or alteration in this area. Thin planks had been nailed into the top of the underlying floor beams, which had then been covered with a layer of mortar.

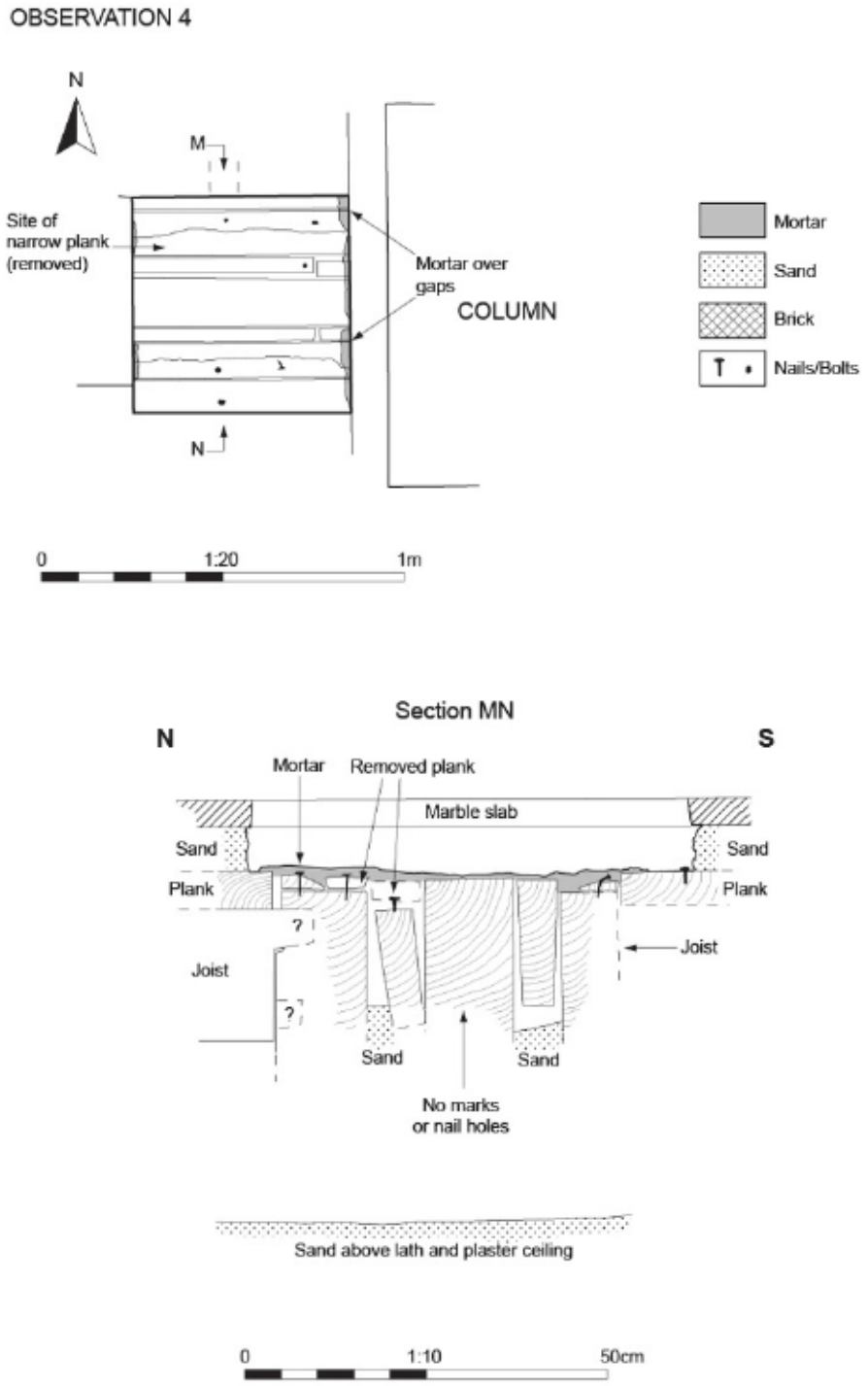


Figure 10: Plan with archaeological observations and cross-sections through OB4

Unfortunately, due to the insertion of additional timbers, it has not been possible to establish the full dimensions of the exposed beams which are interpreted as representing longitudinal beams that span the width of the room between the columns. A cross-section drawing across the beams does however, help demonstrate the stages of alteration (**Figure 10**).

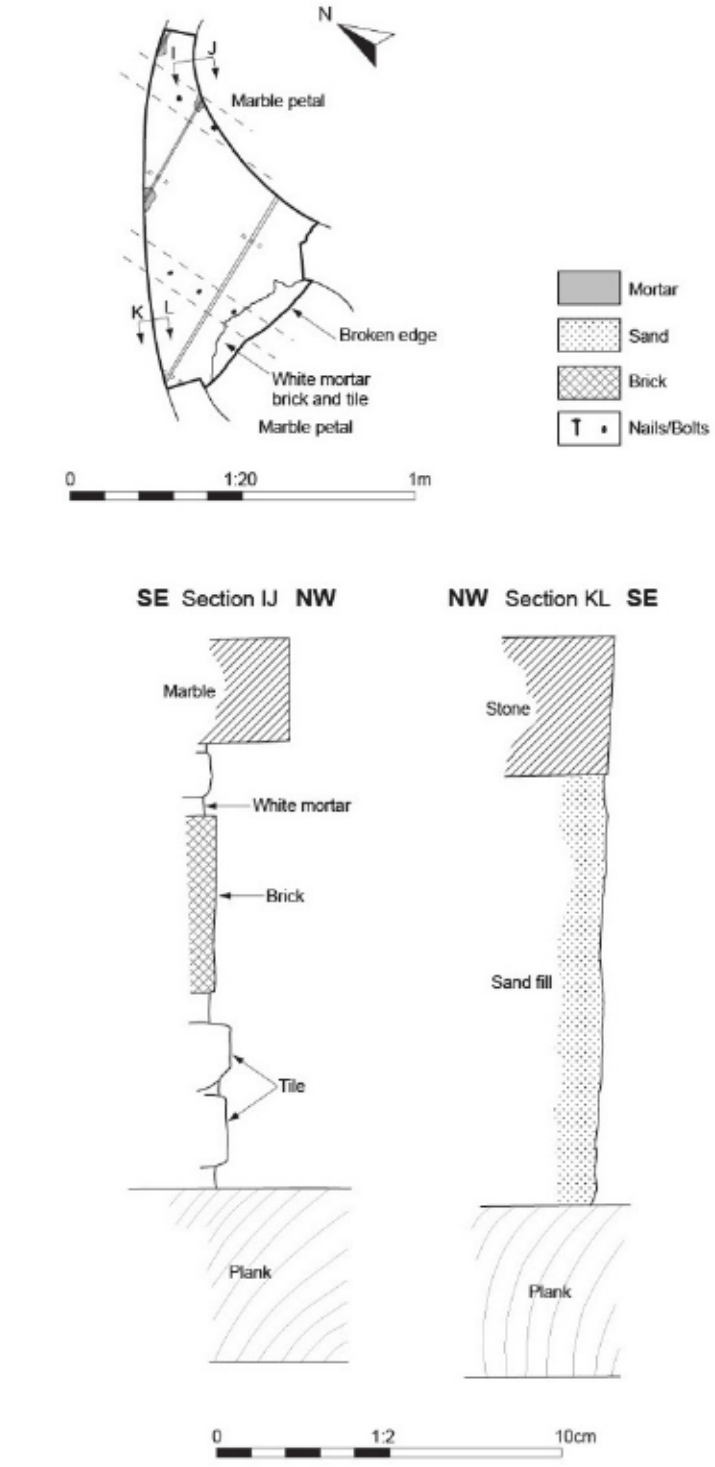


Figure 11: Plan with archaeological observations and cross-sections through OB5

OB5 (NT ref: 2017–01R03)

Two curved sections of paving at the terminal of one of the decorative marble petals was removed in the northwest area of the floor (**Figure 3**). It is an irregular shaped area, c.0.5m x c.1.5m. Following the removal of the marble paving a sub-floor deposit of yellow sand 12.5cm thick was removed (**Appendix 2.17**).

Three timber floor planks were exposed orientated west–east. The central plank was 32cm in width and 4.5cm in thickness. The planks were secured to the upper joints with pairs of nails and fixed to one another with concealed timber dowels (**Appendix 2.19**). The joists were 8cm in width and 35cm apart from one another, being orientated north–south.

Traces of mortar torching over the joists in the planks was noted, although this had largely been removed prior to the archaeological recording being undertaken. No evidence for painted layout lines were noted.

The edge of the foundations for two of the decorative marble petals were recorded, both of which were undercut by 2.5cm from the edge of the stone paving (**Figure 11**). One of these overhanging sections had broken off (**Appendix 2.18**), presumably resulting from a lack of support under the edge. The paving had a slightly beveled edge and traces of white mortar/grout were still adhering to the surface.

OB6 (NT ref: 2017–01R02)

Approximately 60% of the paving slabs within one of the decorative circular motifs in the northeast section of the Marble Hall (**Figure 3**) were removed exposing an area of the floor structure that measured c.1.5m x 2.1m (**Appendix 2.20**). Following the removal of the paving slabs, which were cut as triangular segments, it was noted that cut into the ends of each slab were Roman numerals. These indicate that the slabs were cut and prepared prior to being laid as a floor, presumably in a masonry workshop, or framing yard. The slabs were 3.2cm in thickness.

Following the removal of the sand sub-floor, which was 11.5cm in thickness, the upper surface of the timber floor structure was exposed. This comprised sections of eleven floor planks and two principal floor beams (**Figure 12**). Covering the joints in the planks was a spread of mortar torching (**Appendix 2.22**), consistent with that observed elsewhere within the floor structure. No impressed marks were noted in the mortar.

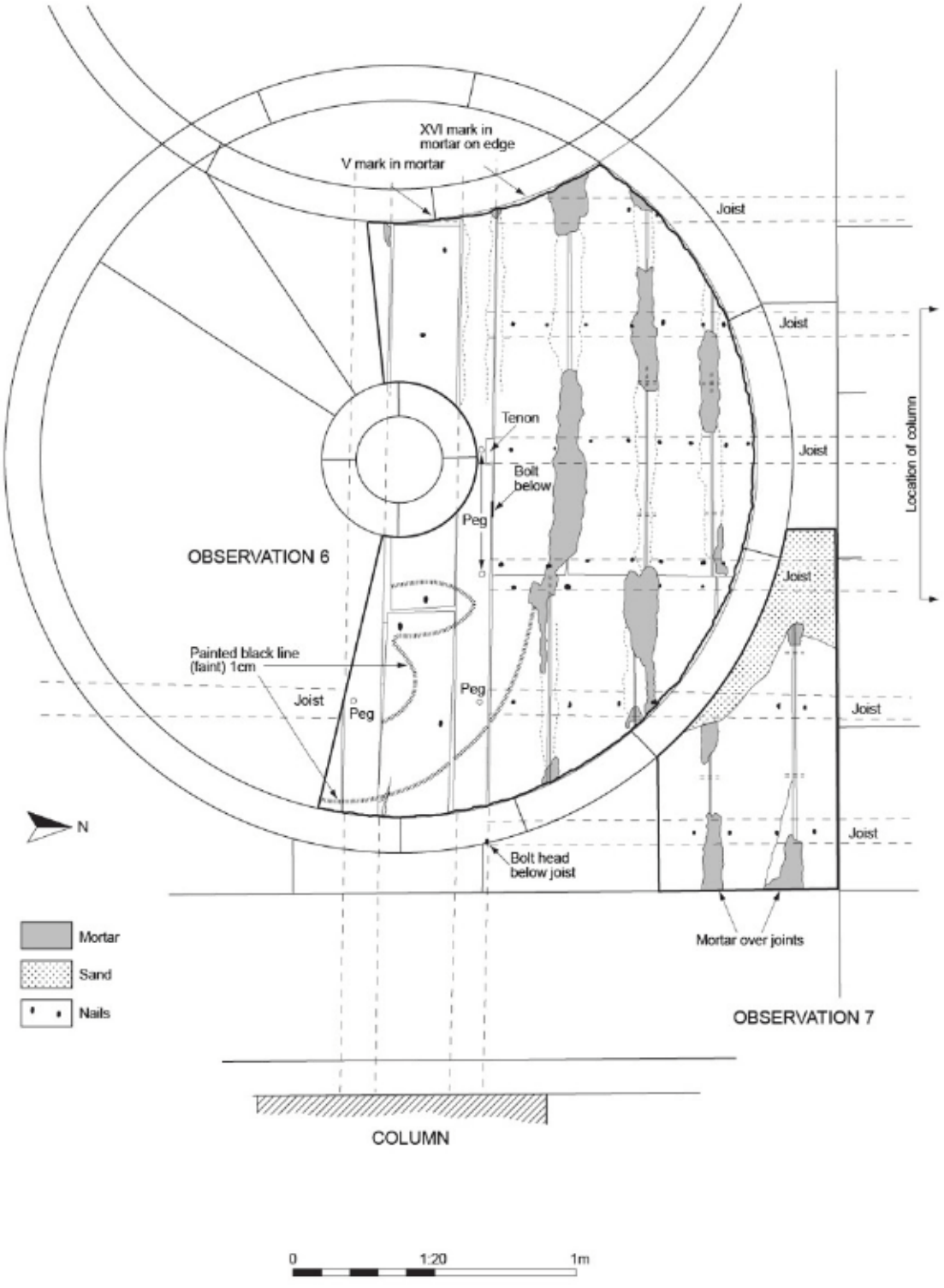


Figure 12: Plan with archaeological observations in OB6 and OB7

The centre of the marble circle of paving comprised a plain decorative roundel of white and grey veined marble (**Appendix 2.25**). Beneath this was a brick and white mortar foundation which had been laid directly over the mortar torching that covered the joints in the floor planks. A similar foundation was noted that supported the external circular strip of white veined marble (**Appendix 2.24**). This comprised of a low curved wall, possibly formed with the use of shuttering that had been removed prior to laying the marble paving. Unlike the foundations beneath the marble petals in OB5, there was no undercut beneath either of these sections of foundation.

In the southern part of the area that had been exposed, the upper face of two parallel beams was recorded. The beams appear to span the full width of the room between the columns located on either side. The timbers are interpreted as representing two of the principal floor beams that measure 12cm in width, extend to the base of the floor void at a height of 47cm, and are assumed to be c.16m in length. Their size is enormous and, as such, were likely to have been placed in position during the construction of the columns, presumably built into the section of masonry between the floor void above Caesars Hall. Within the floor void, two metal bolts (**Appendices 2.27, 2.28**) have been observed at a distance of 1.16m apart on the north face of the northern beam. The use of through bolts may indicate that there are small noggins, or baulks of timber, between each pair of principal floor beams. Unfortunately, due to the restricted nature of access into the floor void, it has not been possible to confirm this interpretation. At the level of the deck of the timber floor, two planks are nailed between the principal floor beams, which does suggest that there are secondary linking timbers between the beams.

Tenoned and pegged into either side of the principal floor beams are upper floor joists (**Appendix 2.21**). A total of five joists were noted in OB6, which measured 8.5cm x 17.5cm and were set at irregular spacing of between 32cm to 40cm. One of the joists terminated adjacent to the central roundel, and whilst it was pegged in position, a rectangular mortice had been cut out of the upper face (**Appendix 2.23**), the purpose of which is unclear.

The timber planks were 22cm to 25cm in width and 4.5cm in thickness. They were secured with concealed wooden dowels and nailed onto the upper joists. A joint in the planking (**Appendix 2.22**) was noted, which was located above one of the upper joist. The edges of the planks were offset from one another, suggestive that they were laid in stages.

Faint traces of two black lines 2cm in width were noted in the southeast area. One was in the form of a lobe or petal (**Appendix 2.26**), and the other a large curved arc (**Appendix 2.21**). The paint extended to the edge of the floor planks and pre-dated the laying of the mortar torching over the joints. Similar to the painted arcs in OB3, these lines do not represent the actual design on the floor of the room. They presumably representing a proposed layout, perhaps similar to the one illustrated on a plan from c.1760 (**Appendix 1.1**), which included various designs and some have been incorporated in the final scheme.

OB7 (NT ref: 2017–01R01)

Two floor slabs measuring 0.63m x 1.27m had been lifted on the north side of the circular marble border that defined OB6 (**Figure 3**). Half of the sand that formed the sub-floor bedding material had been removed exposing three floor planks (**Appendix 2.29**). The sand was 11.5cm in thickness and visually similar in composition and colour to the sand removed from OB6.

The floor planks were secured to one another with concealed wooden dowels (**Appendix 2.30**), set at 43.5cm centres. Each plank was secured to the upper floor joists with pairs of nails, which were covered with mortar torching to prevent the sand from seeping down to the ceiling void below. This void below the floor planks was 42cm in height. The joists were orientated north–south, with the upper joists measuring 8.5cm x 17.5cm and the lower joists 8.5cm x 15.5cm (**Appendix 2.31**). The upper and lower joists were offset from one another by c.6cm (**Figure 13**). The joists were tenoned into the principal floor beams, all of which appear to be oak with prominent medullary rays. At the base of the floor void transverse ceiling joists span between the lower floor joists (**Appendix 2.31**). Many contain saw marks that indicate they were pit sawn, and they are lap joint at each end where the timbers are secured on the underside of the lower joist.

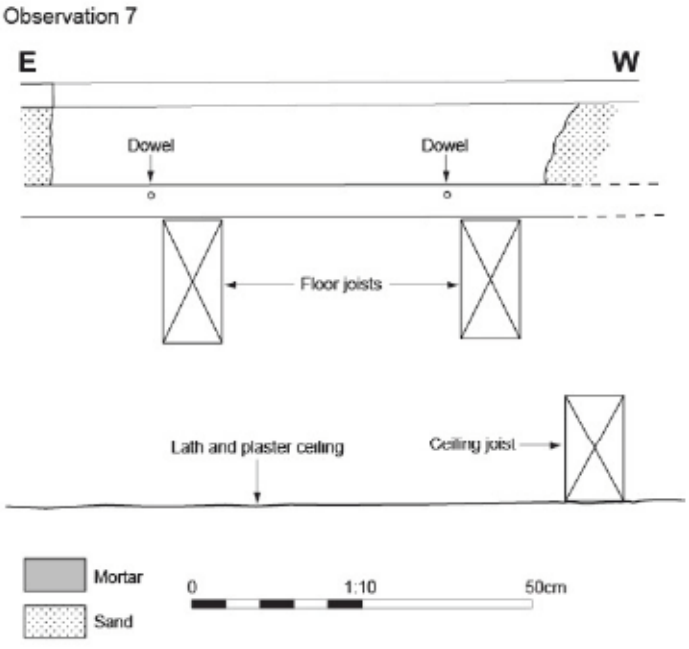


Figure 13: Cross-section (W-E) through OB7

Discussion

Although only very small areas of the floor within the Marble Hall were available for examination, a surprising amount of detail has been recorded and our understanding of its form and layout has been greatly enhanced by this programme of archaeological survey.

The floor is a double joist construction, which was typical of 18th century floors where wide spans were required, or heavy loading was a considered important. The floor is essentially supported on pairs of massive principal joists that are 0.47m in depth and c.10m in length located between the two colonnades along the west and east sides of the hall. There are still aspects of the floor structure that are not fully understood. In particular whether the principal floor beams are trussed in any form and whether they actually span the full width of the Marble Hall. Spanning between the principal beams are upper and lower joists, that in turn support secondary joists for the ceiling of Caesars Hall below.

There do appear to be differences in the floor construction along the western aisle (see OB1) and also along the line of the floor heaters, that are secondary insertions. It is suggested that similar alterations may have occurred along the eastern aisle in the sections of flooring adjacent to the heaters. The depth of the sub-floor deposit of sand is almost half as deep as within the main span of the room and the composition of the sand matrix is notably different. This suggests that when the heaters were installed, the paving around the periphery of the room was re-laid in association with a new floor structure.

The discovery of painted lines on the upper surface of the floor planks suggests that once the main deck of the floor had been created various designs were considered and marked out, prior to the final scheme being agreed. This approach is hinted at when the c.1760 proposal floor plan in the Kedleston Archives (see **Appendix 1.1**) is examined. The illustration divides the room in half with two slightly different designs being presented. It is interesting to note that the existing floor actually contains elements from both designs, such as the three interlocking circle motifs at one end and then the close geometric banding that links each of the column bases together at the other. Unfortunately, the painted lines that were recorded during the archaeological survey do not directly correlate with this plan, and it is possible that other designs were considered and any associated drawings may not survive today.

Perhaps one of the most curious discoveries has been the bootprints prints in the mortar in OB3. Whilst it is difficult to accurately ascribe a date to the design of shoe, they do represent a direct link back to the tradesmen who worked at Kedleston and represent significant discoveries.

6 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This archaeological survey of the floor structure of the Marble Hall at Kedleston has provided a new understanding of the nature of its construction, along with a possible explanation for the cracking of the marble paving.

The sequence of construction of the Marble Hall, which is partially supported by columns on the floor below appears to have integrated the timber superstructure that exists below the sand sub-floor that supports the paving. Whilst the sand and paving may not have been laid until a few years after the roof and other decorations had been completed, in order to slot the floor beams into position, this would have to have been undertaken as the surrounding walls and structural elements of the hall was built around them.

The weight of the floor was considerable and this is likely to have had a direct impact upon the deflection across the whole span of the room. In regards to the localised cracking that has occurred around the edge of a number of the marble paving slabs, it is suggested that this is partly due to movement within the sand matrix that supports them. The gradual loss of sand between the joints in the timber planks would account for a slight change in the density of the layer beneath the paving, and it has been noted that many of the mortared brick foundations beneath the principal decorative elements of the floor, such as the petals, roundels, or circular motifs are slightly undercut from the outer edge of the surface paving. In areas where the sand sub-floor has moved slightly, or if high pressure has been applied to the edge of the paving, the stone has cracked along the edge of the undercut foundation below.

In addition, the survey has identified the impression of boot prints within the mortar torching that was smeared across the joints in the floor planks to prevent the sand from the sub-floor from dropping down to the ceiling void above Caesars Hall. The date of the mortar appears to be an integral aspect of the original floor construction, and is therefore dated to the c.1760-65. The discovery of impression of shoes within plaster below flooring is incredibly rare and should be regarded as being a highly significant discovery. Similar impressions were found below the flooring of the West Range at Chatsworth House in 2013, although these are later in date c.1835.

Although this programme of recording was focused on a series of small areas where the historic fabric of the floor was exposed, it has demonstrated the huge potential for gaining new evidence regarding the construction of the building. Any future works should be undertaken with appropriate archaeological supervision.

RECOMMENDATIONS

1. Once the analysis of the mortar and sand has been completed, the interpretations made within this report should be re-examined to ensure that any variation in fabric can be interpreted in light of the new results;

2. Once the results of any further archive research in undertaken, the conclusions of this report should be reappraised in light of any new evidence;

3. Should any further floor slabs be lifted for repair it is recommended that this should be undertaken with archaeological supervision to ensure that any new details concerning the construction of the floor can be documented. This should be undertaken by a suitably experienced archaeologist who is a member of the Chartered Institute for Archaeologists;

4. The results of this recording exercise should be considered alongside the results of the structural survey and GPR survey, following which a rapid survey of the areas of cracking within the paving should then be undertaken to confirm whether it is mainly associated with areas where undercut foundations are understood to exist;

5. The opportunity should be taken to examine the floor from below in Caesars Hall. This would involve minimal intervention into lath and plaster ceiling, but could provide a much greater understanding of specific details regarding the construction and physical condition of the floor;

6. The observations made during this programme of fieldwork are considered to contribute to our understanding of the construction of Kedleston Hall, and the discovery of footprints from c.1760s should be considered as highly significant. It is recommended that the results are published in a suitable journal such as the Georgian Group, or with the Derbyshire Archaeology Society.

7 SUPPORTING INFORMATION

AUTHORSHIP

This report has been prepared by Oliver Jessop MCIfA. Graphics have been produced by David Watt. Editing has been provided by Manda Forster PhD MCIfA.

ACKNOWLEDGEMENTS

Rachael Hall and Giles Warhurst are thanked for commissioning the project and for providing help and advice during the fieldwork and reporting. Nick Cox and Hannah Reynolds were involved with the investigations of the flooring and their thoughts have been incorporated into this report.

The team at Kedleston including Fiona Messham and are thanked for arranging access and for discussing the recent history of the House.

PROJECT ARCHIVE

The physical fieldwork archive has been deposited with the National Trust (April 2017). Its contents include:

- *A copy of this report;*
- *Background material and research;*
- *Fieldwork records – notes and observations;*
- *Permatrace drawings of archaeological observations;*
- *Prints of digital photographs.*

SOURCES AND REFERENCES CONSULTED

PRIMARY SOURCES CONSULTED: VISUAL RECORDS

- Ordnance Survey maps 1880, 1899, 1922, 1968, 1977, 2016
- NT archives: Design for the Marble Hall floor at Kedleston Hall, c.1760
- NT archives: A cross-section design for the Marble Hall and Saloon, c.1760

SECONDARY SOURCES: PUBLISHED WORKS AND GREY LITERATURE

ClfA (Chartered Institute for Archaeologists). 2014. *Standards and Guidance for the archaeological investigation and recording of standing buildings and structures.* Chartered Institute for Archaeologists: Reading

Harris, L. 1987. *Robert Adam* and Kedleston – the making of a Neo-Classical masterpiece. The National Trust

HE (Historic England). 2016. *Understanding Historic Buildings: a guide to good recording practice*. Historic England: London

Jessop, O. 2013. 'Floorboards and Footprints – construction of the first floor in the West Front at Chatsworth', in *Derbyshire Archaeological Journal* Vol.133, pp145-151

Reed, HH. 2006. *The Works in Architecture of Robert and James Adam*. Dover Publications Inc: New York

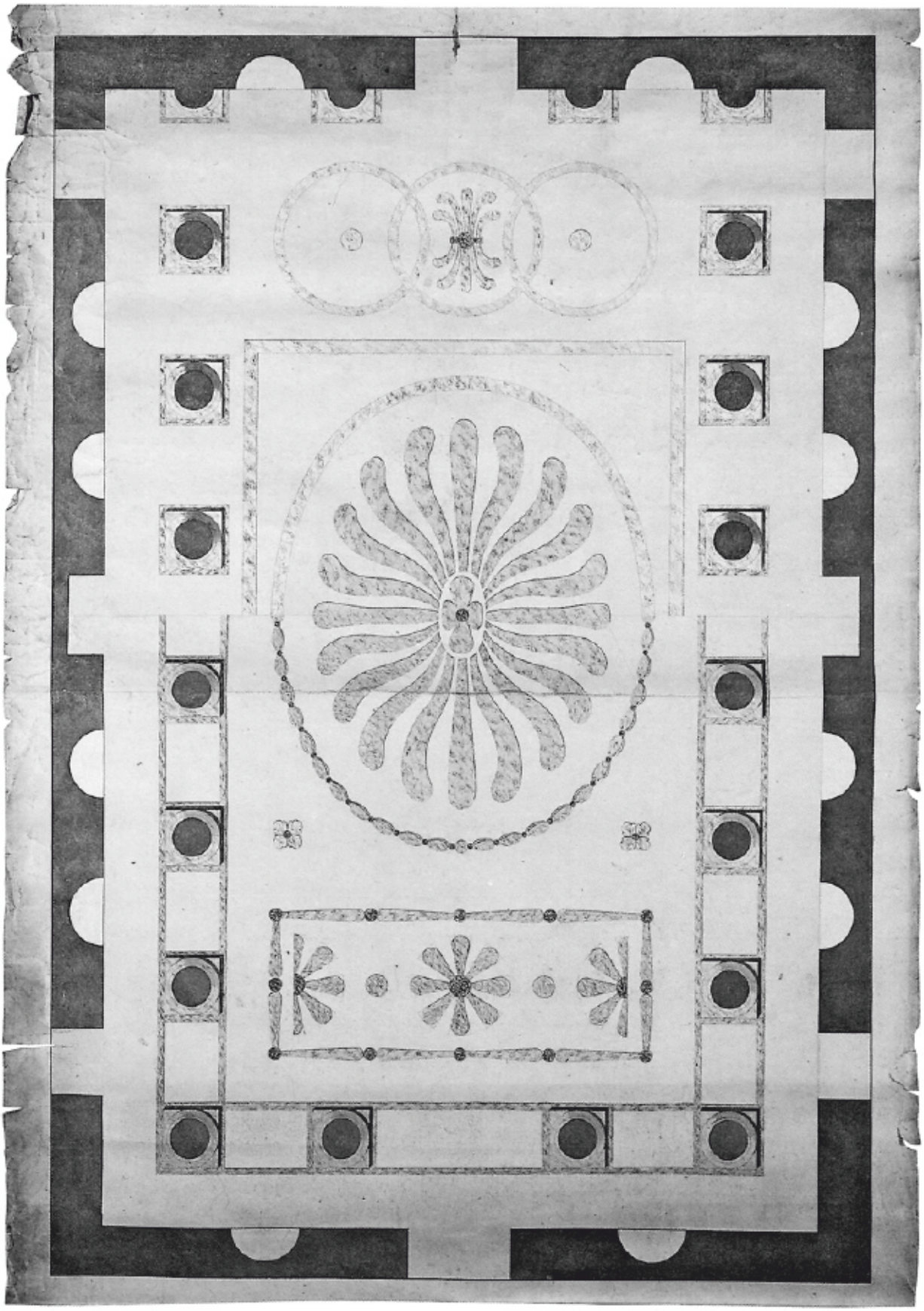
Ridout Associates. 2017. *Report on the condition of timbers under the marble floor at Kedleston Hall*. (unpublished)

INTERNET RESOURCES

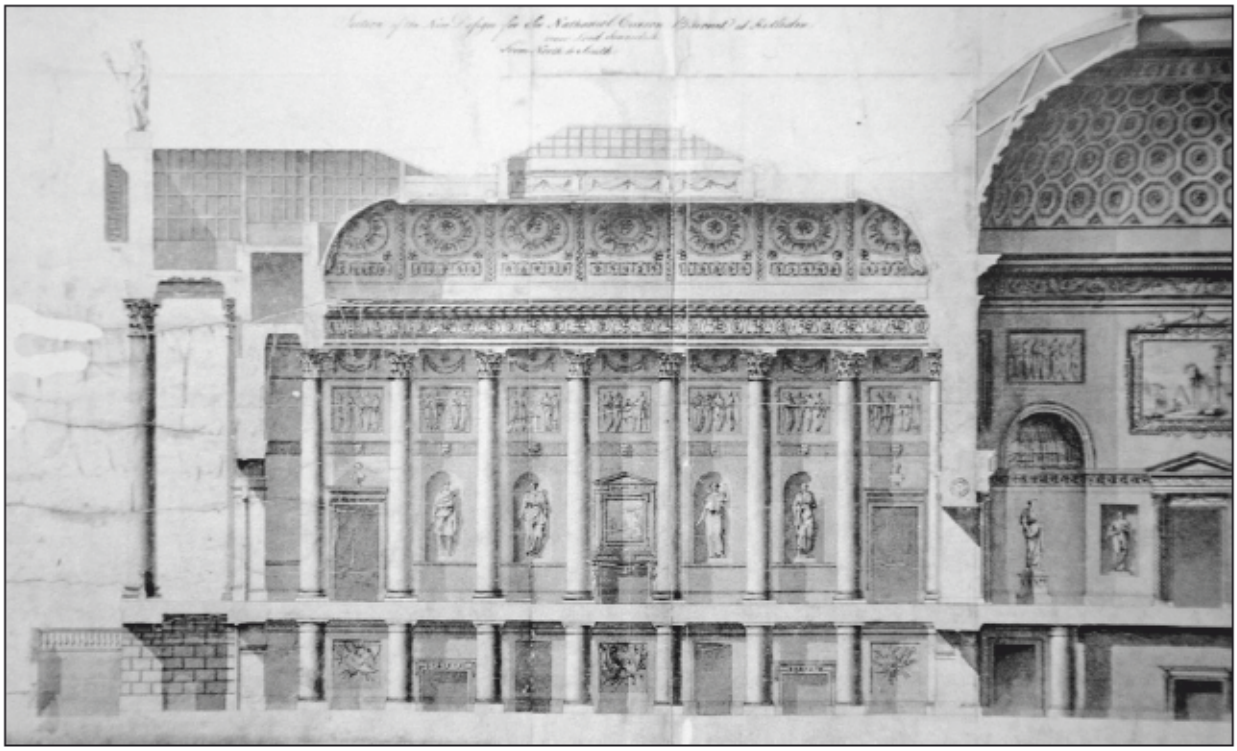
- ADS: www.archaeologydataservice.ac.uk
- Heritage Gateway: www.heritagegateway.org.uk
- National Archives: www.discovery.nationalarchives.gov.uk
- National Heritage List: www.english-eritage.org.uk/professional/protection/process/national-heritage-list-for-england/
- National Trust: www.nationaltrustimages.org.uk

Appendix 1:

Historical sources: illustrations



Appendix 1.1: Design for the Marble Hall floor at Kedleston Hall, c.1760



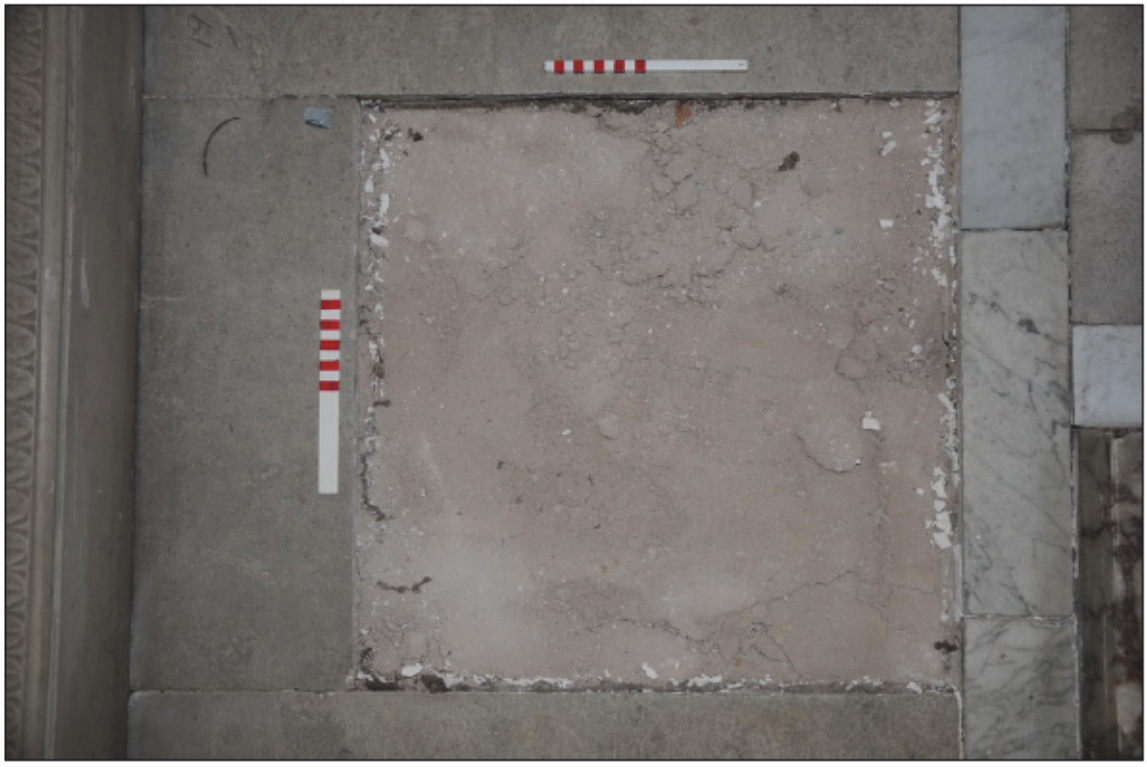
Appendix 1.2: A cross-section design for the Marble Hall and Saloon, c.1760

Appendix 2:

Site Photographs

Appendix 2.1: General view of external elevation from top of incline, looking southwest (3m scale). **Photo No.2**.

Appendix 2.2: General view of south elevation, looking northwest (3m scale). **Photo No.3**.



Appendix 2.3: General view of pale pink sand/mortar subfloor in OB1 (20cm scale). **Photo No.9**.

Appendix 2.4: Detail of exposed floor planks in OB1, looking east; note shallow depth (20cm). **Photo No.15**.

Appendix 2.5: General view of inserted floor heater in OB2 from above (20cm scale). **Photo No.17**.

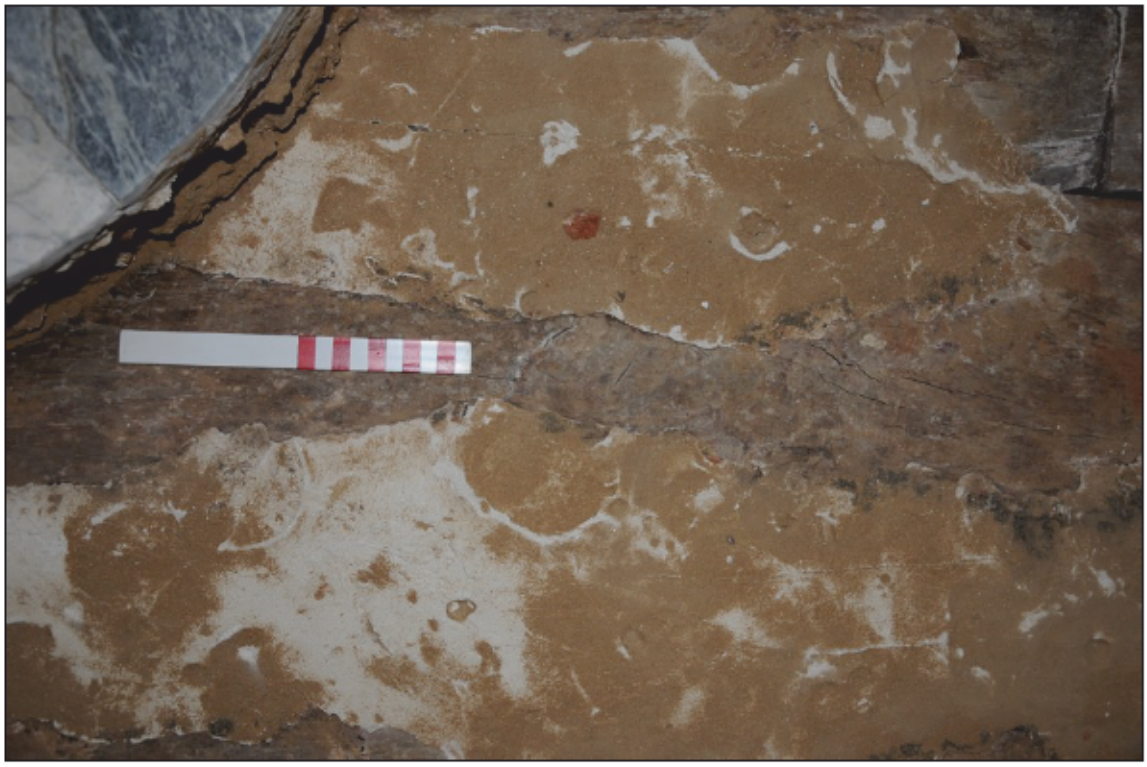
Appendix 2.6: Detail of inserted small RSJ's below floor in OB2 to support floor heater, looking north. **Photo No.23**.

Appendix 2.7: Detail of brick blocking following removal of floor beam below floor in OB2, looking north. **Photo No.20**.

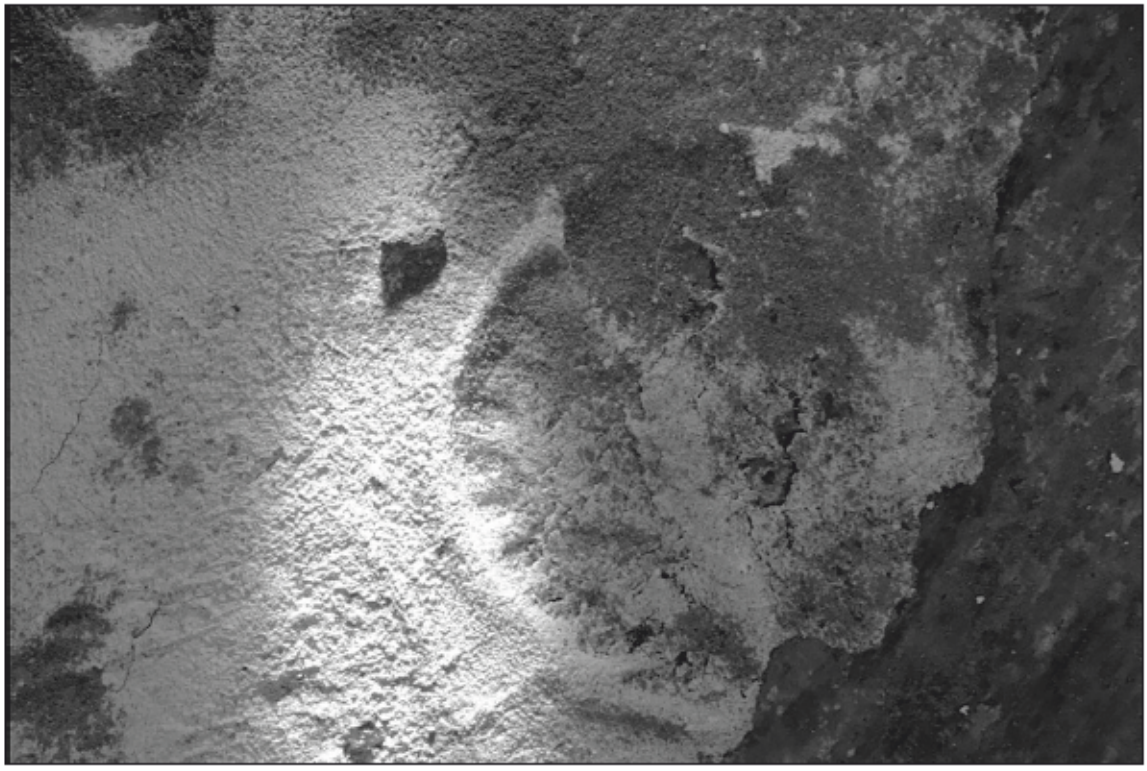
Appendix 2.8: General view of OB3, looking east (1m scale). **Photo No.26**.

Appendix 2.9: General view of OB3 from above, looking north (20cm/1m scale). **Photo No.28**.

Appendix 2.10: Detail of painted lines on floor planks in OB3, looking north (20cm scale). **Photo No.30**.



Appendix 2.11: Detail of shoe impressions in mortar torching in OB3 (20cm scale). **Photo No.31**.



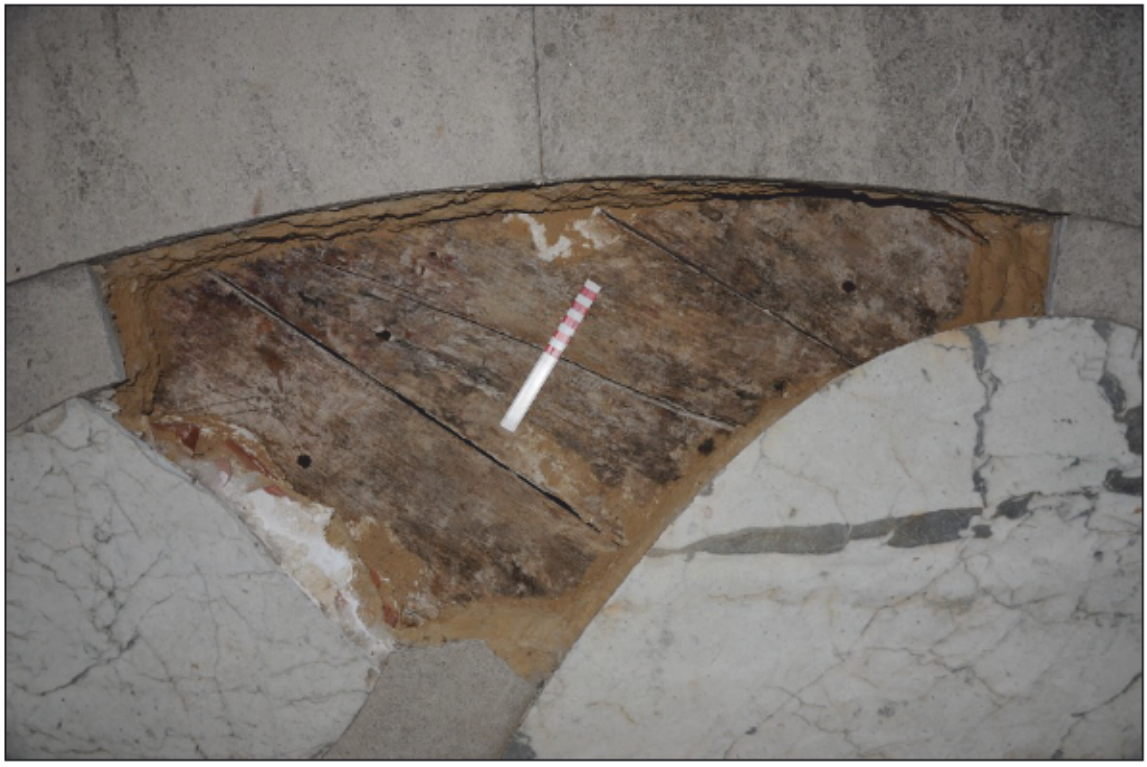
Appendix 2.12: Detail of heel impression in OB3; note hobnails. **Photo No.41**.

Appendix 2.13: Detail of roundel in OB3, looking west; note mortar torching covering joints (20cm scale). **Photo No.35**.

Appendix 2.14: View of floor structure below OB3, looking south. **Photo No.45.**

Appendix 2.15: General view of OB4, looking northeast; note inserted secondary planks (20cm scale). **Photo No.49.**

Appendix 2.16: Detail of flooring in OB4, looking east (20cm scale). **Photo No.51.**



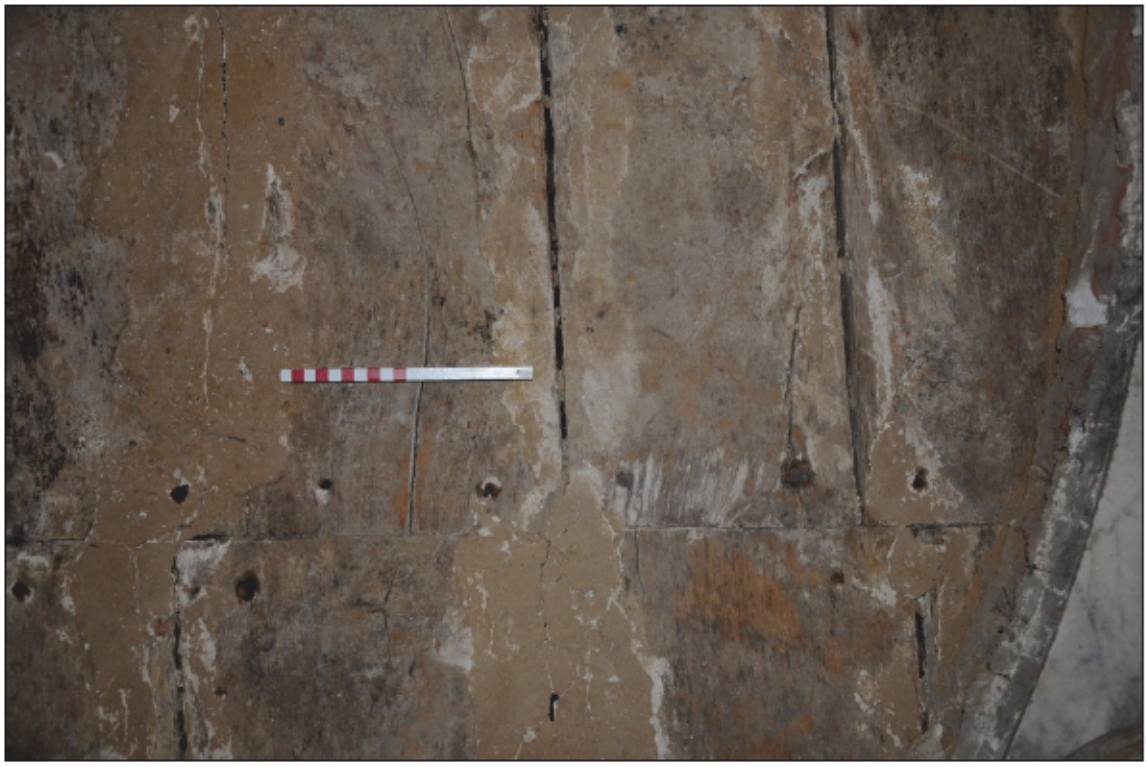
Appendix 2.17: General view of OB5, looking north (20cm scale). **Photo No.57**.

Appendix 2.18: Detail of brick and mortar foundation below marble petal in OB5, looking south (20cm scale). **Photo No.60**.

Appendix 2.19: Detail of dowel between floor planks in OB5 (10cm scale). **Photo No.58**.

Appendix 2.20: General view looking south of OB6 (1m/2m scale). **Photo No.62**.

Appendix 2.21: Detail of painted lines in OB6, looking west (20cm scale). **Photo No.63**.



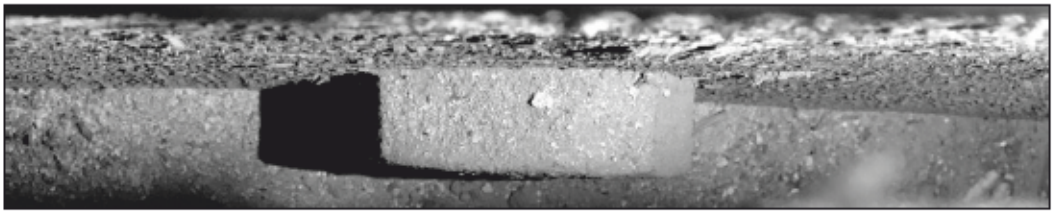
Appendix 2.22: Detail of joint in floor planks in OB6, looking west (20cm scale). **Photo No.67**.

Appendix 2.23: Detail of exposed mortice and tenon in OB6, looking south (20cm scale). **Photo No.80.**

Appendix 2.24: Detail of brick and mortar foundation below outer arc of marble paving in OB6 (20cm scale). **Photo No.75.**

Appendix 2.25: Detail of mortar and brick foundation below roundel in OB6, looking southwest (20cm scale). **Photo No.74.**

Appendix 2.26: Detail of painted leaf/petal in OB6, looking north (20cm scale). **Photo No.83.**



Appendix 2.27: Detail of square nut in floor beam below floor planks in OB6. **Photo No.84**.

Appendix 2.28: View of floor structure below OB6, looking south; note bolt in floor beam. **Photo No.86**.

Appendix 2.29: General view of OB7, looking west (20cm/1m scale). **Photo No.88**.

Appendix 2.30: Detail of dowel in OB7, looking south (1cm scale divisions). **Photo No.91**.

Appendix 2.31: General view of floor void in OB7, looking north; note ceilings joists extend under lower floor joist. **Photo No.96**.

Appendix 3:

Digital photographic register

Frame	Observation	Description	Scale	Direction
1	n/a	General view of investigations in floor	2m	S
2	n/a	General view of investigations in floor	2m	SE
3	n/a	General view of investigations in floor	2m	S
4	n/a	General view of investigations in floor	2m	S
5	n/a	Detail of marble flooring	20cm	E
6	n/a	Detail of marble flooring	20cm	E
7	n/a	Detail of marble flooring	20cm	E
8	OB 1	View to locate OB1	20cm	N
9	OB 1	Detail view from above	20cm	n/a
10	OB 1	Detail view of section of flooring	20cm	N
11	OB 1	Detail view of section of flooring	20cm	S
12	OB 1	Detail view of section of flooring	20cm	S
13	OB 1	Detail view of exposed planks	20cm	n/a
14	OB 1	Detail view of exposed planks	20cm	E
15	OB 1	Detail view of exposed planks	20cm	E
16	OB 2	View to locate OB2	1m	NE
17	OB 2	General view of inserted floor heater	20cm/1m	E
18	OB 2	Detail of inserted floor heater	n/a	N
19	OB 2	View below floor, base of column	n/a	N
20	OB 2	View below floor, brick blocking	n/a	N
21	OB 2	View below floor, brick blocking	n/a	N
22	OB 2	View below floor, metal supports	n/a	N
23	OB 2	View below floor, metal supports	n/a	N
24	OB 2	View below floor, metal supports	n/a	N
25	OB 2	View below floor, metal supports	n/a	N
26	OB 3	View to locate OB3	1m	E
27	OB 3	Detail of exposed floor	1m	NE
28	OB 3	Detail of exposed floor	1m	N
29	OB 3	Detail of exposed floor from above	20cm/1m	n/a
30	OB 3	Detail of painted lines	20cm	W
31	OB 3	Detail of mortar between boards	20cm	N
32	OB 3	Detail of mortar between boards	20cm	N
33	OB 3	Detail of sand below paving	20cm	S
34	OB 3	Detail of mortar below circular roundel	20cm	NW

Frame	Observation	Description	Scale	Direction
35	OB 3	Detail of mortar below circular roundel	20cm	NW
36	OB 3	Detail of sand below paving	20cm	E
37	OB 3	Detail of footprints in mortar torching	n/a	n/a
38	OB 3	Detail of footprints in mortar torching	n/a	n/a
39	OB 3	Detail of footprints in mortar torching	n/a	n/a
40	OB 3	Detail of footprints in mortar torching	n/a	n/a
41	OB 3	Detail of footprints in mortar torching	n/a	n/a
42	OB 3	View below floor planks (void)	n/a	N
43	OB 3	View below floor planks (void)	n/a	N
44	OB 3	View below floor planks (void)	n/a	S
45	OB 3	View below floor planks (void)	n/a	S
46	OB 4	View to locate OB4	20cm	SE
47	OB 4	Detail of flooring from above	20cm	S
48	OB 4	Detail of flooring from above	20cm	E
49	OB 4	Detail of flooring from above	20cm	NE
50	OB 4	Detail of sand below paving	20cm	E
51	OB 4	Detail of sand below paving	20cm	E
52	OB 4	Detail of inserted timbers	20cm	E
53	OB 4	Detail of inserted timbers	20cm	E
54	OB 4	General view of flooring	20cm	E
55	OB 5	View to locate OB5	1m	N
56	OB 5	Detail of flooring from above	20cm	E
57	OB 5	Detail of flooring from above	20cm	W
58	OB 5	Detail of peg in between floor planks	10cm	N
59	OB 5	Detail of peg in between floor planks	10cm	n/a
60	OB 5	Detail of mortar and brick below paving	20cm	S
61	OB 6	View to locate OB6	1m/2m	SW
62	OB 6	View to locate OB6	1m/2m	S
63	OB 6	Detail of painted black lines	20cm	W
64	OB 6	Detail of painted black lines	20cm	W
65	OB 6	Detail of painted black lines	20cm	W
66	OB 6	Detail of floor planks	20cm	SE
67	OB 6	Detail of floor planks	20cm	W
68	OB 6	Detail of floor planks	20cm	S

Frame	Observation	Description	Scale	Direction
69	OB 6	Detail of mortar and brick below roundel	20cm	S
70	OB 6	Detail of floor planks	20cm	W
71	OB 6	Detail of brick and mortar below paving	20cm	W
72	OB 6	Detail of brick and mortar below paving	20cm	W
73	OB 6	Detail of sand below paving	20cm	S
74	OB 6	Detail of brick and mortar below paving	20cm	W
75	OB 6	Detail of brick and mortar below paving	20cm	W
76	OB 6	Detail of joint in floor planks	20cm	W
77	OB 6	Detail of painted black lines	20cm	W
78	OB 6	Detail of painted black lines	20cm	W
79	OB 6	Detail of painted black lines	20cm	N
80	OB 6	Detail of exposed mortice and tenon	20cm	S
81	OB 6	Detail of painted black lines	20cm	W
82	OB 6	Detail of painted black lines	20cm	W
83	OB 6	Detail of painted black lines	20cm	N
84	OB 6	Detail of bolt in joist below floor	n/a	S
85	OB 6	Detail of bolt in joist below floor	n/a	S
86	OB 6	View below floor planks (void)	n/a	S
87	OB 7	View to locate OB7	1m	N
88	OB 7	General view of exposed floor planks	20cm/1m	W
89	OB 7	General view of exposed floor planks	20cm/1m	N
90	OB 7	General view of exposed floor planks	20cm/1m	E
91	OB 7	Detail of peg in floor planks	20cm	N
92	OB 7	Detail of sand below paving	20cm	E
93	OB 7	Detail of sand below paving	20cm	E
94	OB 7	Detail of sand below paving	20cm	W
95	OB 7	Detail of peg in floor planks	20cm	N
96	OB 7	View below floor planks (void)	n/a	N