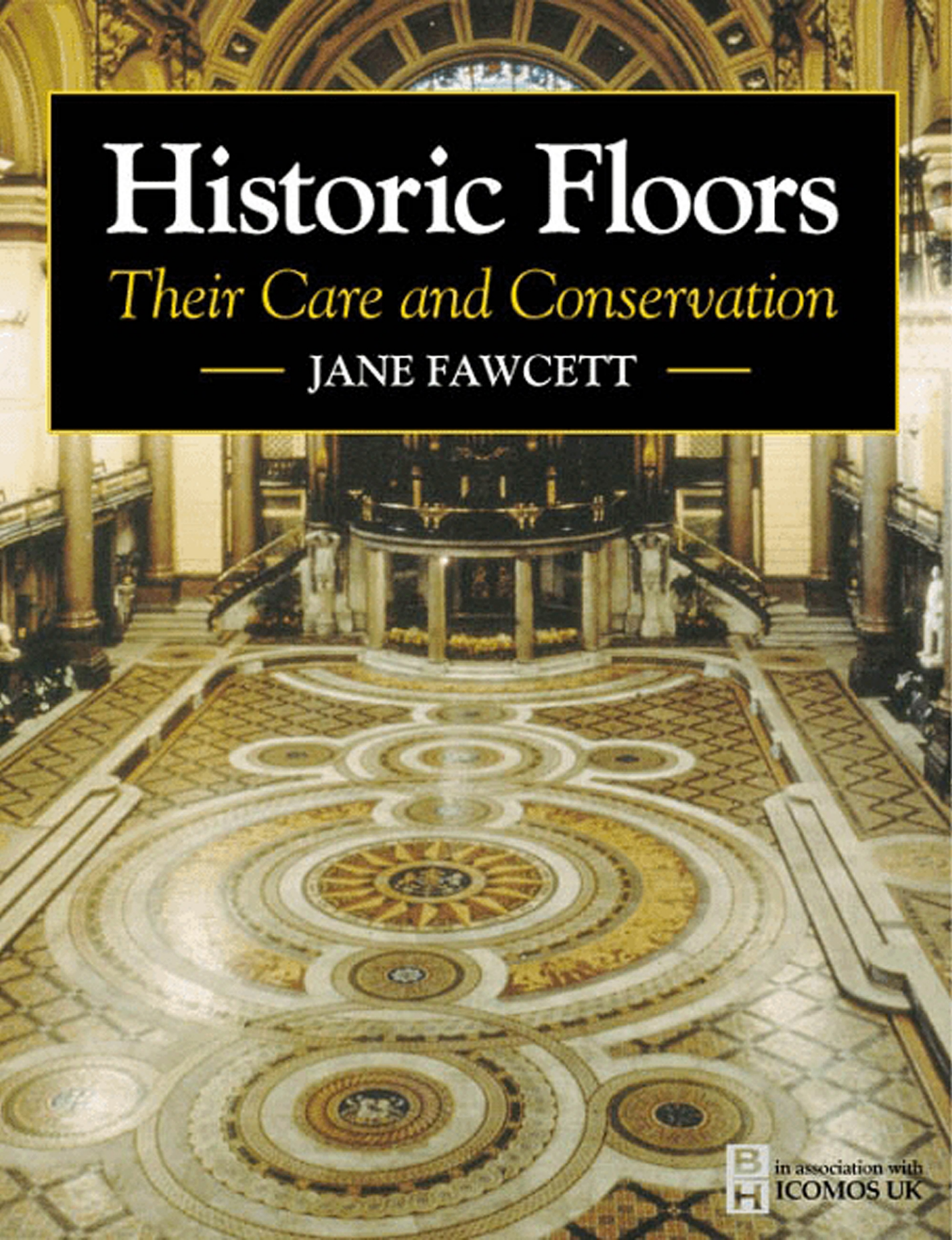
Historic Floors
Their Care and Conservation
JANE FAWCETT
BH
in association with
ICOMOS UK

Historic Floors: Their Care and Conservation

Butterworth-Heinemann Series in Conservation and Museology

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Historic Floors: Their Care and Conservation

Edited by
Jane Fawcett

Published in association with ICOMOS UK (International Council on Monuments and Sites)

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To my beloved husband Teddy

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Contents

Foreword

This book raises the readers' awareness of a neglected, but important, subject. It must be read by ecclesiastical and conservation architects, as well as surveyors and all those responsible for the maintenance and management of historic buildings. It draws attention to areas of floor at risk, and the location of historic features.

The first chapter and final appendix deal with cathedrals, churches and chapels, reviewing the conservation of tiles, mosaics, Cosmati work, marble and stone pavements, together with ledger slabs and brasses. It is full of information and outlines the history of each floor surface. Ledger slabs encapsulate the entire history of lettering, from earliest Gothic to the finest Roman script. Besides iconography, they provide information on heraldry and genealogy. Indeed, once one gets into the habit of reading these ledgers, one finds clues to local and social history. So many women dying in childbirth – even a whole family wiped out by some terrible disease, as were three daughters, aged thirteen, eight and six, of the Rector of Stiffkey in one week in 1771 by a malignant fever.

Each specialist contributor makes useful points. Bernard Barr on documentary sources available to York Minster, followed by Dr Charles Brown dealing with recording ledgers and the possible conservation options. Ross Dallas reviews surveying techniques, together with their application in practice. Jane Fawcett in her chapter on cathedral floors makes many useful suggestions for minimizing wear and tear from both liturgical and touristic angles. She berates cathedral chairs as one of the most destructive of all church furnishings, and suggests they should be fitted with protective pads. In my experience, moving chairs is a major activity in any cathedral. The emphasis on cathedrals and churches may seem too great, but they are too important, with their valuable floors, to be given less attention.

A tremendous amount of historical information is also given on the various floor materials used in palaces and great houses, such as marquetry, plaster, scagliola, marble and stone. Floors become an integrated component of architectural composition, as practised by Robert Adam at Syon House, where his carpet design follows his decorative designs. Donald Insall in his chapter on St George's Hall, Liverpool recognizes the same factor in C.R. Cockerell's floor designs. The wooden floor designs in most of the rooms at Ham House make an important contribution to the *tout ensemble* in the words of Christopher Rowell, who describes their conservation. Curiously, carpets imported from the Orient from the seventeenth century, superseded ever more complex marquetry designs, which originated in the Renaissance from the architect Serlio.

Floors wear out due to foot traffic, much of which is caused by mass tourism. Christopher Hanson-Smith, in the chapter on management of visitors, offers several different methods of controlling the capacity of a building. Once

this critical capacity is exceeded, damage escalates.

I hope I have convinced the potential reader that this is a useful and valuable book. It has certainly raised my own consciousness of the issues involved.

This book is overdue: it had to be written, but it needed Jane Fawcett's energy and dedication to see that this was done. Her contribution of three chapters and the final appendix is formidable and crucial. Her co-ordination of so many contributors was essential and effective!

Sir Bernard Feilden CBE
DUniv DLit HonFAIA FSA FRIBA AADipl (Hons)
Director Emeritus ICCROM
Architectural Conservation Consultant

Series editors' preface

The conservation of artefacts and buildings has a long history, but the positive emergence of conservation as a profession can be said to date from the foundation of the International Institute for the Conservation of Museum Objects (IIC) in 1950 (the last two words of the title being later changed to Historic and Artistic Works) and the appearance soon after in 1952 of its journal *Studies in Conservation*. The role of the conservator as distinct from those of the restorer and the scientist had been emerging during the 1930s with a focal point in the Fogg Art Museum, Harvard University, which published the precursor to *Studies in Conservation, Technical Studies in the Field of the Fine Arts* (1932–42).

UNESCO, through its Cultural Heritage Division and its publications, had always taken a positive role in conservation and the foundation, under its auspices, of the International Centre for the Study of the Preservation and the Restoration of Cultural Property, in Rome (ICCROM), was a further advance. The Centre was established in 1959 with the aims of advising internationally on conservation problems, co-ordinating conservation activators and establishing standards of training courses.

A significant confirmation of professional progress was the transformation at New York in 1966 of the two committees of the International Council of Museums (ICOM), one curatorial on the Care of Paintings (founded in 1949) and the other mainly scientific (founded in the mid-1950s) into the ICOM Committee for Conservation.

Following the Second International Congress of Architects and Technicians of Historic Monuments, which met in Venice in 1964, the Venice Charter was promulgated as a declaration on the fundamental principles of architectural conservation. In the following year, the International Council of Monuments and Sites (ICOMOS) was founded to 'encourage the adoption and implementation of international recommendations concerning monuments, groups of buildings and sites'. Since then, the national committees and international scientific committees of ICOMOS have contributed to the promulgation of several international charters and guidelines on such subjects as historic gardens, historic towns and urban areas, archaeological heritage management, and training. ICOMOS is also one of the bodies delegated to advise the World Heritage Committee of UNESCO on the inclusion of properties on the World Heritage List. A major concern of the various organizations, IIC, ICOM, ICOMOS and ICCROM, is not only to advance the various technical specializations, but also to emphasize the cohesion of conservators and their subjects as an interdisciplinary profession.

The use of the term *Conservation* in the title of this series refers to the whole subject of the care and treatment of valuable artefacts both movable and immovable, but within the discipline conservation has a meaning which is distinct from that of restoration. *Conservation* used in this specialized sense has two aspects: first, the control of the environment to

minimize the decay of artefacts and materials; and, second, their treatment to arrest decay and to stabilize them where possible against further deterioration. Restoration is the continuation of the latter process, when conservation treatment is thought to be insufficient, to the extent of reinstating an object, without falsification, to a condition in which it can be exhibited.

In the field of conservation conflicts of values on aesthetic, historical, or technical grounds are often inevitable. Rival attitudes and methods inevitably arise in a subject which is still developing and at the core of these differences there is often a deficiency of technical knowledge. That is one of the principal *raisons d'être* of this series. In most of these matters ethical principles are the subject of much discussion, and generalizations cannot easily cover (say) buildings, furniture, easel paintings and waterlogged wooden objects.

A rigid, universally agreed principle is that all treatment should be adequately documented. There is also general agreement that structural and decorative falsification should be avoided. In addition there are three other principles which, unless there are overriding objections, it is generally agreed should be followed.

The first is the principle of the reversibility of processes, which states that a treatment should normally be such that the artefact can, if desired, be returned to its pre-treatment condition even after a long lapse of time. This principle is impossible to apply in some cases, for example where the survival of an artefact may depend upon an irreversible process. The second, intrinsic to the whole subject, is that as far as possible decayed parts of an artefact should be conserved and not replaced. The third is that the consequences of the ageing of the original materials (for example 'patina') should not normally be disguised or removed. This includes a secondary proviso that later accretions should not be retained under the false guise of natural patina.

The authors of the volumes in this series give their views on these matters, where relevant, with reference to the types of material within their scope. They take into account the differences in approach to artefacts of essentially artistic significance and to those in which the interest is primarily historical, archaeological or scientific.

The volumes are unified by a systematic and balanced presentation of theoretical and practical material with, where necessary, an objective comparison of different methods and approaches. A balance has also been maintained between the fine (and decorative) arts, archaeology and architecture in those cases where the respective branches of the subject have common ground, for example in the treatment of stone and glass and in the control of the museum environment. Since the publication of the first volume it has been decided to include within the series related monographs and technical studies. To reflect this enlargement of its scope the series has been renamed the Butterworth-Heinemann Series in Conservation and Museology.

Though necessarily different in details of organization and treatment (to fit the particular requirements of the subject) each volume has the same general standard. The aim of the series is to provide authoritative texts for university level courses in conservation and, at the same time, be standard reference material for practising conservators.

The authors have been chosen from among the acknowledged experts in each field, but as a result of the wide areas of knowledge and technique covered even by the specialized volumes in this series, in many instances multi-authorship has been necessary.

With the existence of IIC, ICOM, ICOMOS and ICCROM, the principles and practice of conservation have become as internationalized as the problems. The collaboration of Consultant Editors will help to ensure that the practices discussed in this series will be applicable throughout the world.

Derek Linstrum
Andrew Oddy

Introduction

The protection and study of historic floors is not a national, or even a European issue, but a neglected subject which deserves worldwide recognition. I hope that this book, one of the first on the subject, will pave the way for many more and help to save some of the great floors of the world, and their records, for posterity.

When I was asked by the publishers to write this book, they wished me to extend my original studies on ecclesiastical floors to include representative floors of secular buildings. Furthermore, I was asked to expand my brief to give the book a European dimension. As so little has been written on the subject, this has proved a difficult task, and it has been impossible to do justice to it in the space available. Such a book cannot be comprehensive and I regret the inevitable omissions. I have attempted in chapters 1 and 14 to trace briefly the development of some of the important floors in other parts of Europe outside Britain.

More information is available on the marble, mosaic and parquetry floors of country houses and public buildings than on the ancient and particularly vulnerable floors of cathedrals and churches. Both are in danger from overuse. But whereas the repair of decorative floors, although expensive and requiring specialist skills, can be undertaken, it is impossible to replace a vanished inscription for which there is no record, the eroded surface of a medieval tile or a lost monumental brass. These, once destroyed, are lost irrevocably.

Until recently, the importance of recording had not been understood and the destruction caused to outstanding floors throughout Europe by the dramatic increase in tourism has been disastrous. Without records the loss is permanent, and the speed with which the inexorable tramp of feet has obliterated many of our greatest ecclesiastical pavements has been tragic.

Chapter 1 begins with ecclesiastical floors, which are studied from the first early Christian mosaic and marble pavements through the Renaissance to the Victorian Revival. The introduction of medieval tiles, ledger stones and brasses, their destruction by iconoclasts and recreation during the Gothic Revival is discussed. The development of secular mosaic pavements from 400 BC, and of decorative marble, scagliola, tiled, stone and parquetry floors and of carpets is also briefly outlined.

In successive chapters, leading cathedral archaeologists, architects and surveyors outline the latest methods of recording and repairing some of the outstanding floors in Britain. Several of the authors featured in this volume gave papers at a seminar on the conservation of ledger stones held in 1991, and organized jointly by the Dean and Chapter of York and the Institute of Advanced Architectural Studies, York. The conference was held at The Kings Manor, York, chaired by Professor Derek Linstrum and directed by Peter Burman. It was from that conference, and from the working group set up by the Dean and Chapter to consider the future of ledger stones in the Minster, with Dr Charles Brown as the secretary, that much of the activity which followed, originated.

The care of country house floors, pioneered by the National Trust, and the problems caused by the deterioration of monumental tiled pavements in the Palace of Westminster and St George's Hall, Liverpool, are covered in chapters by leading architects. The management of visitors in order to to protect important floors in heavily visited sites is also considered.

The book ends with an appendix identifying historic floors and areas at risk in British Cathedrals.

I have attempted to check that the information included in the book is correct at the time of writing. If there are inaccuracies, they are my own. I hope that the difficulty of tackling such a large and little-known subject will serve as an excuse for any shortcomings. The editor and contributors have made every effort to trace owners of copyright material and credit them where appropriate. We apologize for any errors and will ensure they are corrected at the first opportunity.

Jane Fawcett

Acknowledgements

My husband, Teddy, has lived with this book for several years, suffered from its demands, steered its course and encouraged me to continue. To him, above all, I am forever grateful.

The generosity of John Smith and The Manifold Trust has enabled us to increase the visual content of the book. I am, as always, in John's debt. Historic Scotland, through David Breeze, has provided a valuable grant for the same purpose. I am most grateful for this support. ICOMOS UK supported my original Cathedral Floor Damage Surveys, and has provided valuable encouragement and support over the preparation of this book.

To my contributors I owe my deep gratitude. They have all made time, out of their busy lives, to support this book, and the cause of conservation to which we are all committed. Without their kindness the book could not have been published. All are distinguished and all under pressure. I salute their generosity.

I am grateful to Bernard Feilden for his encouraging foreword, and to Derek Linstrum for having read the manuscript of the whole book. His advice and guidance have been invaluable. I am also grateful to James Lomax of Temple Newsam, Christopher Rowell of the National Trust and the late Ian Grant, who have read and improved my Chapter 14.

My thanks also to Richard Gem of the Cathedrals Fabric Commission for England who read and offered scholarly advice on chapters 1 and 13. Julian Litton provided useful material on ledger stones and Jane Cochrane gave valuable advice on my medieval tiles section. Ross Dallas, Warwick Rodwell and Charles Brown gave excellent editorial advice.

The information provided by Temple Newsam in the catalogue for their exhibition Country House Floors, 1987, (now out of print) has given me a useful framework for a subject on which very little has been written. It documented many of the developments in design, materials and techniques used for Country House floors in Britain from 1660 to 1850.

My grateful thanks are due to all the cathedral architects who have been kind enough to read and update my cathedral floor studies. Many cathedral librarians and archivists have also given valuable information on floor records and plans, particularly those at St Pauls, Canterbury, Lincoln, Chichester, York and Exeter Cathedrals and at Westminster Abbey.

Dr Nigel Seeley and Helen Lloyd have been generous with their help and advice over National Trust visitor surveys and damage control. Jeff Kelly and Jane Cochrane, former conservation students from the Architectural Association, and Duncan Boddy from the IAAS, York, have prepared excellent theses on historic floors and allowed me to use some of their material. Anthony Cleminson and Roger France have kindly provided photographs for me, so has Axel Griesinger.

Tom Cocke, of the Council for the Care of Churches sent out a questionnaire, which provided valuable information on church

floors. Sandra Davison, and Trevor Proundfoot of Cliveden Conservation, were generous with their expertise. The Monumental Brass Society gave useful guidance, so did the National Monuments Record (now English Heritage) the National Trust and the National Trust for Scotland. Ian Gow, formerly of the Royal Commission on the Ancient Historical Monuments of Scotland, and David Breeze and Richard Fawcett of Historic Scotland, were exceptionally helpful. So was John Fidler of English Heritage.

Ann Crosthwaite has provided considerable help with research and also given much encouragement. Many others who have supported me over the ten years during which I have campaigned for the recognition of historic floors and brought this book, and its predecessor the ICOMOS Cathedral Floor Damage Survey, to fruition, are too numerous to mention. Some are my former students, now in positions of authority; to them I acknowledge my affection and my debt. I wish to acknowledge the help of the staff of the London Library who have throughout the preparation of this book exceeded what could have been expected of them, and given me support in the highest traditions of library service.

The Dean and Chapter of York, by setting up a working group to investigate methods of floor conservation and recording, gave invaluable initial help and encouragement.

The Society of Antiquaries made it possible for me to photograph their material and facilitated my research, and Simon Jervis opened doors for me.

Tim Yates of the Building Research Establishment has carried out research on ledger stones and given much practical advice on conservation.

The information provided by the late Gervaise Jackson-Stops and by Peter Thornton, Margaret Richardson, Mark Girouard, Geoffrey Beard, Anthony Quiney, Kerry Downes and Caroline Sandwich has helped to create some sense out of many disparate threads.

My debt to Nikolaus Pevsner is undiminished. As teacher and friend, his influence and his books have inspired me to many efforts, including, indirectly, this book.

Overseas, I have had a great deal of help and advice from many ICOMOS contacts in Europe, and in America, where Ann Webster-Smith was extremely kind in obtaining information. John Millerchip of Venice in Peril, Wessel Reinink and Arie de Groot of Utrecht, Dirk de Vries of the Rijksdienst voor de Monumentenzorg in Zeist, Netherlands, Jukka Jokilehto and the staff of ICCROM in Rome have all sent me useful information, and Jukka has taken slides of Roman Cosmati pavements for which I am immensely indebted. So has Tim Tatton-Brown.

Dr Arnold Wolff of Cologne Cathedral has been a tower of strength; so has Professor Petzet of the Bayerische Landesamt für Denkmalpflege, Munich. Ditta Paolo Medici of Rome and Dr Koller of the Bundesdenkmalamt, Vienna, have also sent useful material for which I am grateful.

Daryl Fowler, whose chapter on the Conservation of the Excavated Floor makes valuable points about the protection of archaeological floors, died suddenly in 2001. His death is a great loss to the profession.

I am thankful for the patience and kindness of the staff at Butterworth-Heinemann who have worked so hard in the preparation of this book.

And finally, but by no means least, I salute and give thanks to my dear cousin and secretary, Bridget Swithinbank, without whose resourcefulness, patience, tact and skill, this book would never have seen the light of day. While my husband has been the inspiration, and John Smith has provided some of the means, Bridget has been the midwife, without whom it could never have been born.

Contributors

Jane Fawcett
MBE Hon FRIBA LRAM ARCM
Grad Dipl Cons AA
Jane Fawcett, with Sir Nikolaus Pevsner, directed the Victorian Society, and was credited with *Saving a Century*. Jane was awarded the MBE and Hon FRIBA for services to conservation. She was academic tutor and lecturer to the Building Conservation Graduate Course at the Architectural Association, the Secretary and Committee member of the International Council on Monuments and Sites UK, architectural consultant to the Yorkshire Dales National Park and Council member of the CPRE. She re-surveyed the List of Historic Buildings for English Heritage, and was consultant to the English Heritage Tourist Board on Cathedrals and Tourism. She is author and editor of *The Future of the Past*; *Seven Victorian Architects*; *The Village in History*; *Cathedral Floor Damage Surveys*; and *Save the City*. She lectures in Europe, America and Canada.

Warwick Rodwell
DPhil DLitt FSA FRHistS
An archaeologist and architectural historian specializing in ecclesiastical buildings, Warwick Rodwell has directed major excavations and surveys throughout Britain and the Channel Islands since the late 1960s. Consultant to Bristol, Lichfield and Wells Cathedrals, Glastonbury Abbey and many other buildings, he is the author of several books and numerous articles, including *Church Archaeology* (Batsford, 1989), which is the standard textbook on the subject.

Tim Tatton-Brown
Currently consultant archaeologist to Salisbury and Rochester Cathedrals and to the 'Royal Peculiars' of St George's Chapel, Windsor Castle and Westminster Abbey, Tim Tatton-Brown was previously consultant to Canterbury and Chichester Cathedrals. He is a graduate of the Institute of Archaeology at University College, London. From 1966–75 he excavated at various classical period sites in Italy, Libya, Tunisia and Turkey. From 1975–85 he was the first director of the Canterbury Archaeological Trust. He has particular interest in the materials and techniques used to put up large medieval buildings and has made a special study of building stone and its sources in Southern England.

Kevin Blockley MIFA
A full-time field archaeologist since 1976, directing urban excavations in Canterbury and Bristol and rural excavations in Avon, Worcestershire and Wales, Kevin Blockley is principal archaeologist with Cambrian Archaeological Projects Ltd. With a special interest in ecclesiastical archaeology, he has undertaken excavation at Canterbury Cathedral and Pershore Abbey and is Archaeological Consultant to Brecon Cathedral and Archaeological Adviser to the Diocese of Swansea and Brecon.

Bernard Barr
MA FSA FLA
Bernard Barr took a degree in classics before training as a librarian and this background was invaluable in his work at York Minster Library since 1961. He is a fellow of the Society of Antiquaries, past chairman of the Library Association Rare Books Group, a committee member of the Library Association Library History Group and of the Yorkshire Architectural and York Archaeological Society. For a number of years he served on the York Diocesan Advisory Committee, to which he is still Diocesan books adviser.

Charles Brown
DUniv DipArch FRIBA DipLA
Charles Brown has served on Coventry Diocesan Advisory Committee for 28 years and on the

Diocesan Advisory Committee of Birmingham for 10 years. A partner in a private architectural practice, Dr Brown is also a Liveryman to the Carpenters Company, a member of the ICOMOS UK Wood Committee. In addition, he is Architect to a number of other major parish churches throughout the UK. He was also Consultant Architect to Lichfield Cathedral, 1976–83, and Surveyor of the Fabric at York Minster, 1977–94.

Ross W.A. Dallas
BSc FRICS
A specialist in the survey of historic buildings, monuments and sites, and formerly the head of the English Heritage photogrammetry and survey team, Ross Dallas is now an independent consultant. He has been responsible for the preparation of surveys at many important sites in the United Kingdom. A professionally qualified Land Surveyor, he was a member of the ICOMOS International Committee for Architectural Photogrammetry (CIPA) for many years and is a member of the ICOMOS UK Sub-Committee which prepared the recently adopted ICOMOS 'Principles for the Recording of Monuments, Groups of Buildings and Sites'.

Bob Skingle
Bob Skingle has been with the photographic section of the Royal Commission on the Historical Monuments of England (now part of English Heritage) since 1976. His work with RCHME has involved photographic sites as varied as cathedrals, collieries, textile mills, hospitals, prisons, churches and country houses. Several years ago he was the RCHME photographer responsible for a photographic survey of all the ledger stones in York Minster. He is now the team leader for English Heritage's northern photographic section, which covers the north of England, from its regional office in York

Christopher J. Brooke
BSc PhD FSA MIFA MAAIS MRSSoc IHBC
Dr Christopher J. Brooke is currently Head of the Historic Buildings Team at Leicestershire County Council, a Senior Research Fellow at De Montfort University, and a lecturer at Nottingham and Leicester universities. He has developed techniques of ground-based remote sensing for use in archaeology at the University of Nottingham where research in this field is continuing.

Mark Dorrington
Mark Dorrington gained an MA in Medieval History from the University of St Andrews in 1983 and a Diploma in Archives Administration from the University College of Wales, Aberystwyth in 1984. Assistant Archivist for West Yorkshire Archive Service from 1984–87, Archivist at York Minster from 1988–93, Archivist-in-Charge at Lichfield Record Office, 1993–97, he is currently Senior Archivist for Staffordshire Archive Service. A member of English Heritage and The Cathedrals Fabric Commission for England joint working group on Records and Recording of Cathedral Fabric, he is a part-time lecturer at Keele University.

Diana Hale
Diana Hale was formerly responsible for Public Services in the London office of the Royal Commission on the Historical Monuments of England. Prior to that, she worked for many years on developing the computerized cataloguing of the Royal Commission's architectural records. A particular interest in data standards and terminology included participation in various European projects and international working parties as well as work with the Getty Art History Information Program.

Peter Bird
BSc DipArch FSA RIBA
A partner in the practice of Caroe & Partners since 1983, Peter Bird is Architect to a number of National Trust properties in Wessex, Devon and Cornwall, and Church Architect to parish churches in a number of dioceses throughout the UK. In addition, he is Architect to the Cathedrals of St David's, Winchester and Wells and Surveyor to the Fabric of Exeter Cathedral. A 1970 Lethaby Scholar, fellow of the Society of Antiquaries and corporate member of the RIBA, Peter Bird is also a member of the Bath & Wells Diocesan Advisory Committee.

Daryl Fowler
DipArch RIBA AIFA
Daryl Fowler was a Conservation Architect who advised on the care, restoration and management of some of the country's most important historic buildings and monuments. In addition to extensive practical experience in the UK and overseas he lectured throughout the UK and abroad. He was Vice President of the ICOMOS International Committee for Historic Towns and was a member of the Executive Committee and the Education Committee of ICOMOS

UK. Daryl Fowler founded the Conservation Practice in 1989 and was Director, responsible for the work at Uppark. In 1997 he became the Director of Cultural Heritage at Broadway and Malyan. BMCHC had an extensive network of consultants who were used where relevant to solve clients' problems with their cultural assets. Current projects included work for the UK Government, the Government of Hungary, London Transport, English Heritage and private clients. Daryl died in 2001.

Christopher Rowell
MA

In 1977 Christopher Rowell was appointed to the Historic Buildings Department of The National Trust. He was Historic Buildings Representative in Wales from 1979–86, and has covered the Southern region since 1986. He has been concerned with the interiors and collections of Ham House since the V&A Museum relinquished its lease in 1990. His other curatorial responsibilities include Uppark and Petworth in West Sussex and Polesden Lacey in Surrey. He also participated in the repair of Uppark after the 1989 fire. He is currently reassessing the interior at Polesden Lacey. Christopher Rowell has written several National Trust guidebooks, articles on the history of the display and exhibition of art, and is the co-author of *Treasures from India: the Clive Collection at Powis Castle* (1987) and *Uppark Restored* (1996).

Iain McLaren

Iain McLaren studied architecture at the Bartlett School, 1959–64, and first became involved with historic buildings in 1975 with a study of Chatham Dockyard for the PSA. Other projects included the conversion of the former City of London Boys' School and the reconstruction of Richmond Terrace, Whitehall. He joined The Conservation Practice, Midhurst, in 1989 and was appointed Project Architect for the repair and conservation of Uppark for the National Trust in 1990. Iain McLaren is currently working on Eltham Palace in South East London for English Heritage and on the Old Market Hall, Hove, for the Hanover Band.

A.T. Jardine
TD DipArch RIBA MIMgt

Andrew Tertius Jardine, born in 1938, was educated at St Paul's and the School of Architecture, Regent Street Polytechnic. As a Principal Architect in the Department of the Environment he had responsibility for major new works as well as for works to Listed Buildings including the Palace of Westminster. Currently Conservation Architect at the Palace of Westminster, he particularly enjoys the challenge of finding apt solutions to modern requirements in a living Listed Building. He also served in the Territorial Army with the Royal Engineers and the Intelligence Corps, attaining the rank of Major.

Donald Insall
CBE RWA FSA FRIBA FRTPI SPDip

Donald Insall is the founder-director of the well-known architectural practice of Donald Insall Associates, who have wide experience in urban and building conservation projects and in designing new buildings for sensitive situations. This Practice has received over 70 international, national and local awards for design and craftsmanship. Donald Insall was also a founder-Commissioner of English Heritage and of the Advisory Committee to the Getty Grants Program. He serves frequently on the Expert Committees of the European Commission and lectures widely at home and overseas.

Christopher Hanson-Smith
MIPR

Christopher Hanson-Smith helped to manage many National Trust properties during the 28 years he worked for the Trust. His particular discipline was in public affairs, which included communicating with and managing visitors with the aim of reconciling public access and the preservation of the properties. He is now a lecturer and a leader of cultural tours both in the United Kingdom and overseas.

Impartiall reader, seest thou this worke?

Beleeve me it cost me much labour, swett and tiresomenesse,

Through my toilsome travailes, viewing of places and turning

over of bookes. Sitt thou still if thou please and enjoy it.

Farewell

(From the title page of an unpublished translation of about 1630 of Scamozzi's treatise on architecture of 1615, in Sir John Soane's Museum.
By courtesy of the Trustees of Sir John Soane's Museum)

1

Decorated pavements and floor monuments in European cathedrals and churches

Jane Fawcett

1.1 Introduction

To understand the intentions of medieval builders, one must remember that medieval churches and cathedrals were richly decorated. Vaults, bosses, corbels, capitals, statues, screens, pulpits, choir stalls and organ cases were often painted. Altars and tombs were highly decorated. Wall paintings covered the walls, and all the windows were filled with stained glass. It is in this context that one must consider medieval pavements. They were designed to provide another dimension to an interior that, particularly in the chancel, was a riot of colour. In some cases the relationship between the wall paintings, the stained glass, the monuments and the medieval tile designs was very close, and the decorative scheme conceived as a whole.

When one adds the treasures, plate, reliquaries, vestments and manuscripts, one appreciates what treasure houses cathedrals and many greater churches were in the Middle Ages. Gothic Revival architects attempted to reinstate this medieval richness. Their encaustic tiles and Cosmatesque pavements represented an important element in this revival. William Burges, architect of St Finbar's Cathedral, Cork, and of St Mary's, Studley Royal, Yorkshire, said that our ancestors 'had their churches made as beautiful as they could afford. A great cathedral must have been an encyclopaedia of all the knowledge of the time ... It is only by acting in a similar manner that we shall ever progress and have an art of our own' (Burges, 1867).

The following sections consider some of the features that make up ecclesiastical floors, dating from the early Middle Ages to the present day, covering a period of over 800 years. The two main components of church floors are the decorated pavements, designed to enrich the interiors, and the floor memorials, commemorating the dead. Mosaic pavements and ceramic tiles were used to decorate the most significant areas, usually the chancels, chapter houses and libraries. Black and white chequered marble floors were introduced in the sixteenth century, and continued through the nineteenth century. The nave and transepts were paved, sometimes in contrasted colours, and occasionally tiled. Incised slabs, ledger stones and monumental brasses once covered many of the church floors, creating a rich historical jigsaw. Unfortunately the disasters of the past 500 years have destroyed many of these, along with the furnishings to which they related. During and after the Reformation,

almost all the furnishings that had been venerated were systematically destroyed, in a purge of all that was considered idolatrous. Monumental brasses were plundered, often for the value of the brass.

The iconoclasm of the Civil War, when many cathedrals were used as barracks or stables, also caused widespread damage to floors. The neglect of the eighteenth century and the restorations of the nineteenth century followed. It is surprising, after such a turbulent history, that any ancient features have survived. Furthermore, natural deterioration has often caused floors to be repaved, during which many ledger stones were either destroyed, or moved, so that they have been divorced from the burials to which they related.

The constant disruption to historic floors caused by the steady increase in under-floor burials up to 1852 also created damage. Liturgical changes, causing the introduction or removal of screens, pews and other furnishings, the wear patterns arising from constant liturgical routines and the regular movement of congregations, also had their effect. Even more serious was the reordering and restoration by nineteenth-century reformers. But whereas most of the glass, furnishings and statues were destroyed by iconoclasts, or as a result of liturgical reforms, of the few surviving medieval tile pavements many have had their decorative surface wiped out by tourists. The installation of services, including electric wiring and heating, has also caused serious damage to historic floors, and is often carried out without adequate supervision.

Formerly cathedrals were used predominantly for worship. During the last few decades congregations have declined, and cathedrals have been promoted increasingly as venues for tourists, a use which their delicate fabric cannot withstand. Their many treasures are increasingly prone to the theft and vandalism for which they are natural targets. Even medieval floor tiles have been stolen. Increased wear has obliterated many medieval tiles, brasses and ledger stones and most of those surviving are in a terminal state. This makes their protection extremely urgent. The mass tourism of the past 50 years has caused more damage than that inflicted over the previous 700 years.

The tragedy is that so little remains. The almost total loss of medieval furnishings, including tiles and brasses, stained glass, screens, roods, statues and wall paintings, together forms one of the major art losses of the civilized world.

1.2 Tile pavements

Anglo-Saxon polychrome relief tiles, dating from the tenth to the eleventh centuries, have been identified in a number of ecclesiastical sites, including Westminster Abbey, in the undercroft, dated before 1065 (Betts *et al.*, 1991). Further examples have been found in St Edmund's Abbey, Bury St Edmunds, at Winchester Cathedral in the demolition levels of the old minster, demolished in 1093, at Peterborough and Coventry Cathedrals, and St Albans Abbey (Gem and Keen, 1981). Examples have also been found at Canterbury Cathedral (see Chapter 4). The great tile pavement of the twelfth century in the chapter house at St Albans was excavated by Martin Biddle in 1979. Some of the tiles were re-set in the north transept, and the designs copied in the chancel during the nineteenth-century restoration. The rest are in storage awaiting a decision about their future.

Anglo-Saxon tiles were made in wooden moulds, the design in modelled relief was impressed with a wooden stamp while the clay was still soft, then glazed and baked. Yellow and brown, the predominant colours, were obtained by the addition of copper and iron to the lead glaze.

Similar relief tiles were found in the early nineteenth century in the Cistercian convent of North Berwick and are now in the Royal Scottish Museum, Edinburgh and the British Museum, London. The thirteenth-century kiln at North Berwick, discovered by workmen in 1908,

Figure 1.1 Byland Abbey, Yorkshire. Thirteenth-century *opus sectile* tile mosaics containing 900 tesserae, south transept chapel (Photograph, Jane Fawcett)

is the earliest known floor tile kiln in Britain, predating the Clarendon Palace kiln of c.1240 by several years. It was fully documented by James Richardson, Inspector of Ancient Monuments, Ministry of Works, Scotland, in 1928 and by Christopher Norton in 1994. The tiles, which have polychrome patterns in high relief, are similar to those found in monastic, Cistercian sites in England and are probably late twelfth century or early thirteenth century in date. Similar tiles have been recorded in Cistercian houses in Europe, dating from c.1200. The subjects of dragons with foliate tails, fleurs-de-lys and leaf forms are unusually decorative for Cistercian foundations, and particularly so for a Cistercian nunnery; these were usually poorly endowed and plainly decorated. North Berwick was, however, an important port in the middle ages, used by pilgrims travelling to St Andrew's Cathedral, hence the possible continental influence. The unusually high survival rate of high relief tiles found at Cistercian sites in Britain and Europe may be the result of their remote situations, with consequently less probability of disturbance.

Plain ceramic tiles were also imported, in the late middle ages, and have been found in Linlithgow Palace (chapel floor), Dunfermline, Balmerino and Kinloss Abbeys, St Andrew's Cathedral, Fife, and at Melrose Abbey. These tiles, usually dark green or yellow, are identical to Flemish tiles imported into England, particularly along the east coast (see Chapter 3). They had a virtual monopoly of the British market for about 150 years, until their decline in the sixteenth century.

Mosaic tiles may have been copied from *opus sectile* marble floors, the ceramics being a substitute for the marble used in Italy (see p.55). They are recorded in France from the early twelfth century, but one of the earliest known examples of the use of these tiles in England was at Fountains Abbey, between 1220 and 1247. There are still some tiles reset near the high altar. The glaze has almost completely gone. The tilers probably came from Cistercian monasteries on the Continent, where similar pavements were also laid, at a time when England and France were culturally very close. One of the earliest mosaic tile floors in France is in the Chapel of Ste Geneviève at the Abbey of St Denis in Paris. It dates from the second half of the twelfth century (Herbert and Huggins, 1995).

Mosaic tiles were made of coloured ceramic sections, cut in segments and arranged to form geometric patterns. Slabs of clay were rolled out, the mosaic shapes marked with templates, cut, fired and glazed. The glaze was lead based, but could be coloured by the addition of iron or copper.

The mosaic tile pavements at Byland Abbey, Yorkshire, of the mid-thirteenth century are among the best examples of their kind in Europe (Figures 1.1 and 1.2). There are still sufficiently coherent areas in the chancel and in the south transept chapels to enable one to imagine the effect they must once have made, when the abbey was complete. There are 900 tiles, comprising over forty designs, and made up of quatrefoils, circles and curvilinear segments. The Rievaulx Abbey tiles, of which a few patches still remain in situ, were of a comparable date and composition.

The Monastic Chronicle records that the church at Meaux was paved with mosaic tiles between 1249 and 1269, and continued in use until the Dissolution. These mosaic pavements were thought to have been designed by monks, and the templates used to make the tesserae may have been passed from one monastery to another, hence the similarity in many designs.

At Ely Cathedral, Prior Crauden's Chapel of 1324 has retained almost intact a floor which combines mosaic tiles and line impressed tiles, depicting Adam and Eve in front of the altar, with an assortment of animals. Its survival is probably due to the fact that the chapel was very little used. Line impressed tiles were decorated with linear designs, applied when the tiles were still soft. The nave is divided into three tile carpets, with lions and mythical tile beasts at each end.

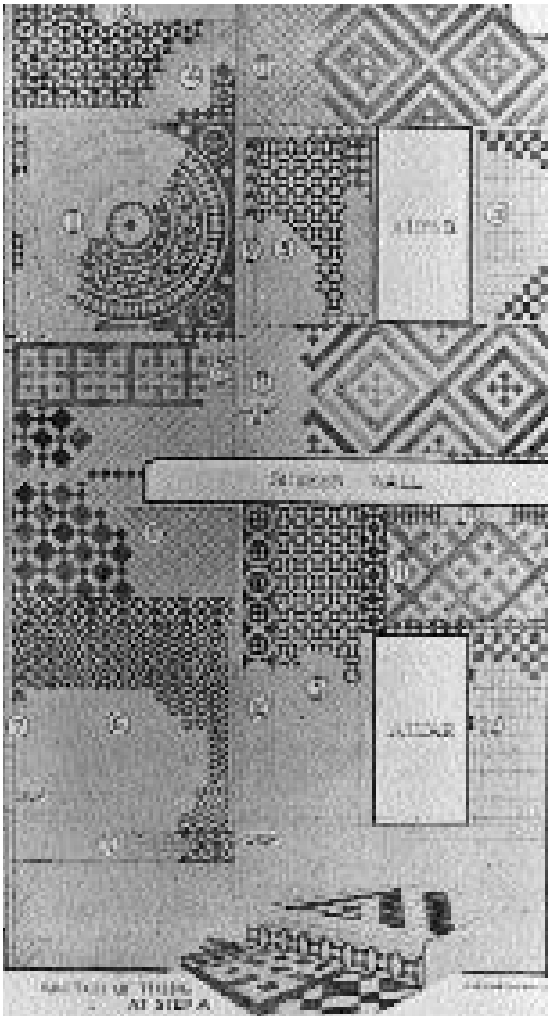

Figure 1.2 Byland Abbey, Yorkshire. Plan of pavements in south transept chapels by James Richardson 1928–1929 (Photograph, Crown copyright. Reproduced by Courtesy of Historic Scotland)

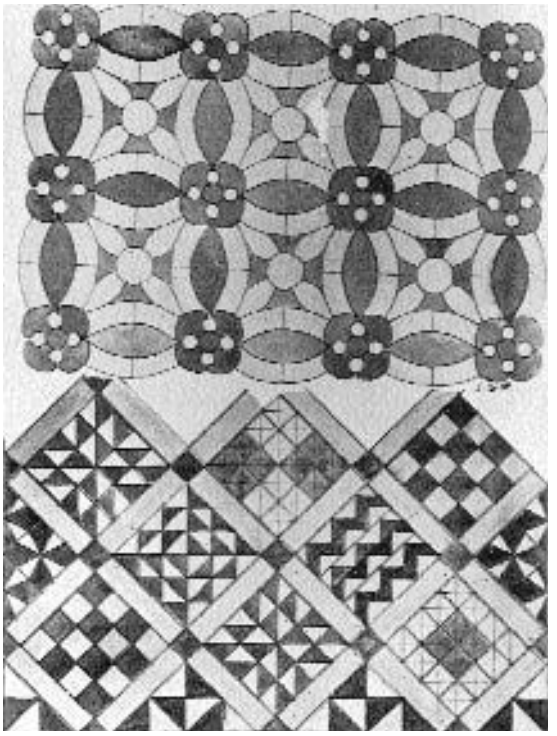

Figure 1.3 Newbattle Abbey, Lothian, Scotland. Mid-thirteenth-century tile mosaics, reconstructed by James Richardson, 1928–1929 (Photograph, Crown copyright. Reproduced by courtesy of Historic Scotland)

Opus sectile mosaic tiles were also found at the Cistercian Abbey of Newbattle, near Edinburgh (Figure 1.3).

Mosaic tiles were used widely on the Continent from the late twelfth century, and continued until the 1230s, when inlaid tiles were developed. These were less labour intensive, and rapidly took over from the earlier technique, until by the late thirteenth century mosaic tiles had been abandoned.

Many tileries were established in England from the mid-thirteenth century onwards, each with its own recognizable style, producing two-tone inlaid tiles. These were made by indenting a white pattern into a square red tile base. The clay was pressed into a wooden mould, and then stamped, while still soft, with a wooden stamp. The imprint was filled with white clay or slip, smoothed off, glazed and baked. The master tiler assembled the different tile designs and arranged them in blocks, strips or panels divided by plain tiles to create the tile carpet. These tiles were popular throughout England until the Reformation. Little is known about the origins of the designs but some of them, such as the fish, the double headed eagle, and the tree of life, with two birds, are clearly Christian symbols of Byzantine origin. This process arrived in Britain, as a fully developed method, from Normandy. Its introduction may have resulted from the marriage of Henry III to Eleanor of Provence in 1236 (Eames, 1992). The earliest known English example of an inlaid tiled floor was laid for Henry III in St Stephen's Chapel, Westminster Palace, in 1237. Tilers started with the main area, in front of the altar, and divided the remaining area into carpets, separated by borders. Each carpet contained groups of tiles set in panels, varying from 4 to 36 tiles, divided by plain strips (Cochrane, 1993). Initially, glazed tiles were expensive, and their use was largely confined to royal and monastic buildings. By the late thirteenth century commercial tileries had developed and continued until the Dissolution of the monasteries in 1539 brought a virtual end to their production.

The royal tileries were working for Henry III at Westminster Abbey, Clarendon Palace and Winchester Castle. The magnificent tile pavement in the chapter house at Westminster is known to have been completed by 1258, when Henry III ordered that any surplus tiles should be used at St Dunstan's Chapel. This pavement is one of the finest and most complete medieval tiled floors to survive. It was covered, from the time of the Reformation, by a timber floor and used as a record office until it was restored by Gilbert Scott in 1863 (see Plate 1). The range of designs and the coherence of the tile carpet give one some idea of the original splendour of many medieval pavements, now so fragmentary. The designs include scenes from Aesop's Fables, hunting scenes, foliage

designs, heraldic beasts, royal coats of arms, a border design of pike, and the design for a rose window, thought to have been the original rose window in the south transept of the abbey. The tiles were laid in fifteen panels, all of patterned tiles, running from east to west across the octagonal floor. The octagonal area of a chapter house required a more complex layout than rectangular floors. At Salisbury, the medieval chapter house floor tiles were divided into radiating wedges, coming from the central column. This layout was repeated in the restored pavement of 1856 (see p.10 and Plate 4).

Tiles for Chertsey Abbey, which are of exceptional delicacy, were made c.1350 and decorated with spirited scenes of mounted knights in armour, scenes from the legend of Tristan and Isolde, and from the life of Richard Coeur de Lion. Both the workmanship and the composition were outstanding and in advance of any other tiles of the period known in England or France (Eames, 1992).

The period of activity of the Wessex tileries stretched from c.1235 to c.1450. Wessex tiles had a distinctive style derived from a number of tileries in the West Country, including Great Malvern. They were used to pave Winchester, Wells, Salisbury (see Plates 3 and 4) and Gloucester Cathedrals, Great Malvern Priory and also Hailes, Glastonbury, Muchelney, Cleeve (see Plate 2) and Titchfield Abbeys. The tiles portrayed individual subjects, including griffons, lions, coats of arms and fleurs-de-lys. Several of these abbeys still contain exceptional thirteenth-century medieval pavements, some still in situ. The Muchelney pavement has been relaid in the present church. The retrochoir at Winchester Cathedral contains Wessex tiles of c.1235, and is one of the most important remaining spreads of medieval tiles in Britain, recently conserved (see Chapter 12).

In Gloucester Cathedral, part of Abbot Seabroke's pavement of 1455 survives in front of the high altar. It contains groups of 4, 9 and 16 patterned tiles, divided by black strips. The north ambulatory chapel also contains an important pavement of medieval tiles, some still in situ. There are also many random medieval tiles, alternating with ledger stones, in the Lady Chapel. Canon Welander reports that the medieval tiled floor still exists below the eighteenth-century flagstones in the nave (Welander, 1991).

The tilery near Canterbury, operating from the mid-thirteenth to the mid-fourteenth century, made tiles for Rochester and Canterbury Cathedrals and for St Augustine's Abbey. Two late thirteenth-century tile pavements in the northeast corner of the Corona at Canterbury were laid c.1285–1290 after a visit by Edward I (Horton and Norton, 1981). The tilers may have come from France (Eames, 1992).

Muniment rooms have experienced less wear and less repaving than other areas, and a few important pavements still survive. For the tiles used to pave the muniment room at Westminster Abbey in the mid-thirteenth century, designs included a mounted knight, a bird, fleurs-de-lys and a foliate cross. The surface of the tiles is rarely flat, and some of the decoration is smudged, owing to faults in manufacture. Nevertheless, they have remained in situ.

The very fine tiled floor of the muniment room at Lichfield was, until recently, covered with library bookshelves placed there in 1910 (see Plates 19–21). The pavement of c.1300 was laid as a series of seven parallel carpets and has remained intact, despite wear in certain areas. It was wholly unrecorded until it was rediscovered recently (see Chapter 2). At Salisbury in the muniment room there is a splendid tiled floor of c.1260 of Wessex tiles still in place and preserved by a wooden floor. The tiles are similar to Henry III's tiles commissioned for Clarendon Palace, also from the Wessex tileries (see Plate 3).

The muniments tower at New College, Oxford, has four vaulted upper rooms, with splendid tiled floors c.1386, the upper two largely undamaged. They are approached, as at Salisbury and Lichfield, by narrow spiral stairs, for security reasons. There are also tiled floors in the Consistory Court at York Minster,

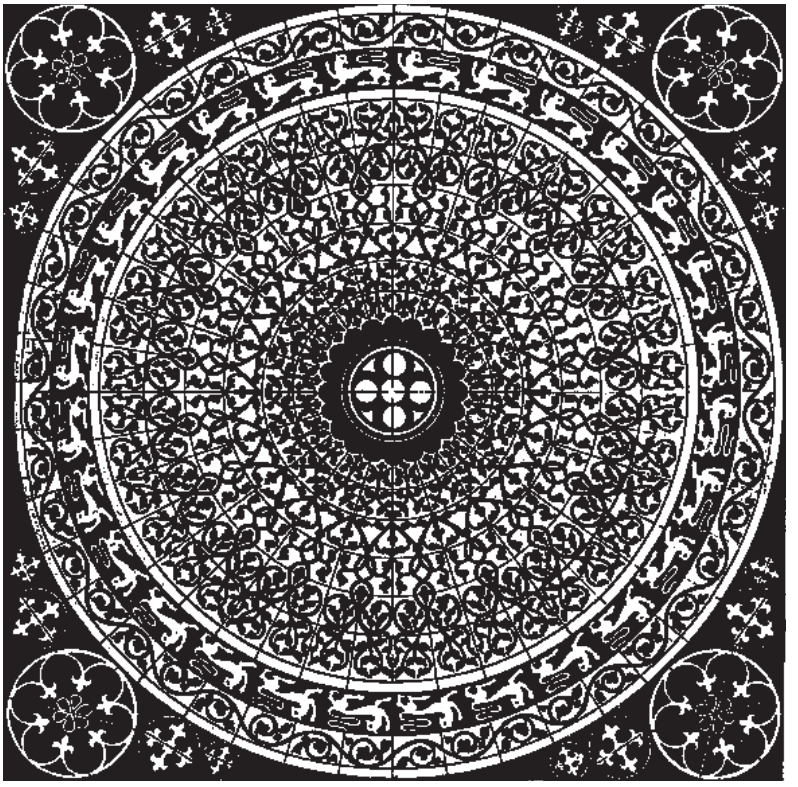

Figure 1.4 Jervaulx Abbey, North Yorkshire. Thirteenth-century tile setting, made up of 452 curvilinear inlaid tiles, excavated in 1807, recorded by Henry Shaw, and published, after total destruction by frost, in 1858. Henry Shaw's *Specimens of Tiled Pavements* recorded all the most famous medieval tiled floor layouts known in the mid-nineteenth century, in order to provide information for the Victorian tile manufacturers.

the library at Worcester Cathedral and the muniment rooms at Winchester College (Norton, 1996).

At Tewkesbury Abbey a fine pavement in the Founder's Chapel is more or less undamaged and there are smaller areas of medieval tiles, resited. Worcester Cathedral once contained a number of medieval tiled pavements, most of which have been obliterated by wear during the last few decades. An inlaid tile pavement of 1377–1380 still survives in the office of the Custos, and on the balcony overlooking the chapter parlour. Neath Abbey, West Glamorgan, contains a few exceptional fourteenth-century tiles, representing knights on horseback, a huntsman and a stag pursued by dogs.

The Tile and Architectural Ceramic Society are compiling inventories of in situ medieval tiles in parish churches, but we still have little idea of how many exist. There are, however, both medieval and replica tiles in the chancel of Chastleton Church, Oxfordshire, the church of St Cross Hospital, Winchester c.1390, and some fourteenth-century line impressed tiles at Icklingham Church, Suffolk. There are also medieval tiles surviving in Bangor Cathedral, Wales, Brook Church, Kent and Acton Burnell, Shropshire. St Swithun's, Launcells, near Bude, Cornwall, contains rare fifteenth-century Barnstaple ware tiles in the chancel. Designs include Tudor roses, lions, passant and rampant, a pelican and fleur-de-lys.

Many monastic tiles were covered by ruins for several centuries, and so protected. Some were, however, sold with other fittings, at the Dissolution. Tiles from Rievaulx Abbey were sold to the Earl of Rutland, the first lay owner. During the antiquarian revival of interest in Gothic ruins in the late eighteenth and early nineteenth centuries, many tiles were collected and found their way into museums. Other medieval tile pavements were, however, recorded by antiquarians during the 1830s and 1840s; these designs were included in the

catalogues of enterprising tile manufacturers, and so came to the notice of leading Gothic Revival architects.

The early thirteenth-century tile pavement from Jervaulx Abbey was recorded after excavation, and is the only plan to survive of a complete pavement in an abbey church. Tragically, the floor was excavated in 1807, exposed to the weather, reduced to fragments by frost, and by the time the drawing by Henry Shaw was published in 1858, nothing remained (Figure 1.4).

It is also unfortunate that, through failure to recognize the fragility of medieval tiles, so many have been defaced in recent years. The design is rapidly lost when the external glaze is broken down by wear. Repaving in the eighteenth and nineteenth centuries and overuse in the twentieth century has meant that a major art form has been more or less obliterated.

Figure 1.5 Sainte Chapelle, Paris. Nineteenth-century copy of thirteenth-century tile (Photograph, Dombau Archiv, Cologne)

1.2.1 The Victorian revival

It is now relevant to consider the influence exerted by medieval tiled floors on the architects of the Gothic Revival.

From the 1840s the Oxford Tractarians, led by Newman, Keble and Pusey, promoted a revival of interest in ritual and liturgy. The Cambridge Camden Society demanded ecclesiologically correct churches, requiring them to conform to the Early English or Middle Pointed style which they considered the only acceptable form. They also insisted on the construction of raised, stalled and enclosed choirs, suitably furnished, the enlargement and reseating of churches, and the repaving of floors, which this necessitated.

Church architects, if they wished to succeed, had to conform. In order to construct Gothic Revival interiors, they replicated many of the rare medieval prototypes, including tiles, brasses and mosaic and marble pavements. This led to the development of what Beresford-Hope, President of the Cambridge Camden Society, called Art Manufacture. Hardman, Minton, Farmer and Brindley, and many others, grasped the opportunity and developed successful businesses, manufacturing neo-medieval artefacts to pour into the new Victorian churches. This movement also led, regrettably, to the destruction of many medieval floors, because the architects truly believed that their new products were better than the worn originals. Burning with religious zeal, they were determined to make a thorough job of their churches. And so, to a certain extent, they did.

1.2.2 Encaustic tiles

The prosperity of the Victorian economy, the demand for larger churches owing to a growing church-going population and the commitment of leading architects to medieval precedents, set the stage for the encaustic tile revival. Encaustic is a term for a glazed, decorated and baked earthenware tile. The application of decoration, which had proved so difficult in the middle ages, also proved troublesome to the early Victorian manufacturers, who pioneered a new technique to overcome this problem.

Samuel Wright, a potter from Staffordshire, took out a patent for his process of manufac-

turing two-tone encaustic tiles in 1830, but the project failed. In 1835 Herbert Minton bought Wright's equipment, and his patent, and proceeded to develop his own techniques (see Chapter 14). Minton's interest in tiles had been aroused by his discovery, with A.W. Pugin, of a medieval tilery at King's Lynn in 1833. At about the same time the Great Malvern medieval tilery had also been discovered and publicized. Minton's techniques were founded on medieval methods, as revealed by fragments found at the King's Lynn tilery. The clay was put into square moulds, decorated with inlaid or relief patterns, glazed and baked in kilns. Many medieval tiles had worn unevenly owing to the variable quality of the clays used. Herbert Minton attempted to overcome the irregular contraction of the clay, which caused the inlaid pattern to become dislodged from the tile. Of him Sir Matthew Digby Wyatt said that 'notwithstanding repeated failures . . . he . . . at length succeeded in producing tiles very far superior to those of the ancients' (Jones, 1993). It was, however the 'ancients' who inspired the designs.

Augustus Welby Northmore Pugin was central to the Gothic Revival movement. He collaborated with Herbert Minton, and together they promoted the use of encaustic tiles, a collaboration which culminated in the pavements for the Palace of Westminster, for which Pugin designed many original tile patterns (see Chapters 14 and 18). With the exception of Scarisbrick Hall, most of Pugin's tiles were designed for Roman Catholic churches and cathedrals, many of which have suffered from reordering. Both at St Chad's Cathedral in Birmingham and at Killarney Cathedral in Ireland, two of his major commissions, the encaustic tiled floors, together with most of the other furnishings, were destroyed in the 1960s and 1970s. Fortunately, St Giles, Cheadle, one of his most spectacular churches, designed for the Earl of Shrewsbury, still contains all its original furnishings, including the floor tiles.

Pugin, who was received into the Roman Catholic church in 1835, became a passionate convert. His publications, advocating Gothic as the only true ecclesiastical style, were very influential. So, also, were his designs. Benjamin Ferrey, writing *Recollections of A. Welby Pugin* in 1861, stated that 'among the various objects occupying Pugin's attention, not one received a greater share than the revival of the manufacture of encaustic tiles'.

It is unfortunate that Herbert Minton, with whom Pugin collaborated so closely on the production of tiles, was unable to reproduce the delicate colours used by Pugin in his water colour sketches. There was concern about the crude colour of many encaustics. Lord Alwyne Compton, Bishop of Ely, who designed pavements for Ely Cathedral and several churches, was anxious that Minton's encaustic tiles should reproduce the colours of the medieval originals. He wrote to Herbert Minton, having sent some of his drawings: 'I am glad that you have made out . . . the green colour of the strip tiles . . . I suppose your experiments were chemical. I should like to know the result' (Jones, 1993).

Pugin and George Gilbert Scott were keen members of the Cambridge Camden Society. After reading *The Ecclesiologist*, the Society's publication, Scott said 'Pugin's articles excited me almost to fury, and I suddenly found myself like a person awakened from a long feverish dream'. After visiting Pugin he 'became a devoted reader of his writings and visitor of his erected works' (Scott, 1879). Pugin tragically became insane and died in 1852 at the age of forty.

Interest in medieval tiles was increased by the discovery of the medieval tiled floor in the Chapter House at Westminster Abbey. The designs were used by James Savage and Sydney Smirke for their new floors at the Temple Church. 'Mr Savage was allowed . . . to take up the wooden floor of the Chapter House, Westminster, in order that he might examine the original tile paving, which, being of the same date as the Temple Church, was an example completely in point' (Burge, 1843). The tiles for Temple Church were made by Minton, who 'made a series of reproductions, on a smaller scale than the originals, but

excellent in technique, and with these the Temple Church was paved' (Clayton, 1912). These unfortunately replaced the medieval tiles already in situ, and have themselves been replaced.

Minton's first pattern book of 1835 had already contained copies of the Westminster tiles, and the first Minton catalogue of 1842, *Old English Tile Designs*, was based on medieval examples. Minton also copied the medieval tiles in the church of the Hospital of St Cross at Winchester and patched the original floor with them.

Gilbert Scott was, he said, 'wholly unexpectedly appointed architect to Westminster Abbey' in 1849.

> This was a great and lasting source of delight. I at once commenced a careful investigation of its antiquities . . . I also devoted much time to the investigation of the Chapter House. The floor of the Chapter House is probably the most perfect and one of the finest encaustic tile pavements now remaining. It is, happily, in a nearly perfect state, having been protected by a wood floor. I have thoroughly examined it, and find it to be arranged in parallel strips from east to west, the patterns changing in each strip, though repeated on the corresponding sides. Many of the patterns are most noble in their design, and some of extraordinary delicacy and refinement. The uniformity of the pavement is in one place disturbed by the insertion of a number of tiles containing figures, such as St John giving the ring to the Confessor etc. Many of the patterns have been pretty correctly copied by Mr Minton for the pavement of the Temple Church, and many are given by Mr Shaw in his recent work on *Encaustic Pavements* (Scott, 1863)

Scott restored the pavement in 1863–69 (see Plate 1).

The discovery of the Westminster Abbey pavement aroused considerable interest among antiquaries, and John Gough Nichols published a set of twenty-four facsimiles of medieval tiles at Winchester Cathedral and Romsey Abbey in 1841, entitled *Examples of Gothic Inlaid Tiles*, 'as a means of directing the attention of architects to that mode of pavement for churches . . . which is most appropriate and accordant with ancient example'. In 1842 his second publication entitled *Examples of Encaustic Tiles* included facsimiles of the Westminster Abbey tiles.

This was followed by further publications, as antiquarians recorded the excavation of more medieval tiles. Henry Shaw's *Specimens of Tile Pavements, Drawn from Existing Authorities* was published in 1858, and contained many examples from recently excavated sites. The Chertsey Abbey tiles, excavated in 1852, and now in the British Museum, were recorded by the antiquarian Shurlock who sent copies both to Scott and to Minton (Kelly, 1994). Shurlock finally published the designs in 1885, after Scott's death.

The newly founded encaustic tile manufacturers, Maws, produced a catalogue in 1852 which included designs from the medieval tile pavement at Jervaulx Abbey, Abbot Seabroke's pavement at Gloucester Cathedral, and pavements at Worcester and Oxford Cathedrals, later retiled by Scott (see Chapter 14, p.133).

The firm of Godwin and Lugwardine was founded in 1848. *Building News* stated that Godwin:

> paid particular attention to the reproduction of medieval patterns in their entirety, both as to facsimile of form and ornament, and antique appearance of surface. He thereby attracted the attention of the late Sir Gilbert Scott RA who was so well satisfied with his productions that he invariably specified Mr Godwin's tiles to be used in the many ecclesiastical works with which he was connected . . . Mr Godwin's tiles have been used to pave no less than ten English, one Scotch, three Welsh, and two Colonial Cathedrals, besides many thousands of churches and secular buildings. (*Building News*, 1890)

Minton claimed to have repaved the floors of nine cathedrals for Scott.

The ecclesiastical workshops, which grew up when it became apparent that there was

an urgent demand for new church furnishings, were condemned by Beresford-Hope, in a lecture on the art-workman's position, in 1864.

> We all know that the . . . Gothic movement (of the last thirty years) . . . of which the pioneers were Pugin and Barry . . . created . . . a great and sudden demand for sculpturesque Art . . . Education towards that result was not forthcoming; capital towards it was ready and abundant and thus has grown up a system of . . . Art on commission, carried out by middlemen under the direction of the architect . . . Now this is what architectural and applied art is rapidly verging to. Do not call it Art-practice but Art Manufacture – then it is all right.

T.G. Jackson, himself an eminent cathedral restorer, said in 1873 'One man designs the wall, floors, and roofs . . . another man designs the statues . . . each man knows his branch of art and is ignorant of that of the others'. Jackson also said of Scott that he 'had a wonderful power of making rapid expressive sketches and from these his men were able to produce work which . . . did fall into something of a consistent style that passed for Gilbert Scott's'.

Gilbert Scott is credited with working on over 870 buildings, many of them ecclesiastical, of which twenty-eight were cathedrals or greater churches (Cole, 1980). On the subject of floors, Scott, speaking to the RIBA 'On the Conservation of Ancient Architectural Monuments and Remains' in 1862, said that 'floors must be levelled and freed from damp, but monumental slabs and old tiles should be left: one should not be compelled to say the memorials of the dead have perished, and the works of Mr Minton (to which they have fallen victims) have scornfully ousted those of his teachers'. In the same paper he declared 'never renew unless essential; never smarten up; keep all old bits'. This is very difficult without constant personal supervision which, of course, he was unable to provide. On the whole Scott, with his dictum of 'leave well enough alone', showed considerable respect for important earlier burials, and often left medieval brasses or ledger stones in situ, surrounded by new encaustic pavements. At Ely he retained the slabs to Prior Crauden and Bishop Hotham in the chancel. At Tewkesbury, he marked the position of medieval burials in the chancel with a brass cross or initials, and retained the ledger stone to Maud de Burgh.

Ely (Scott's first cathedral restoration), Worcester (see Plate 5), Lichfield, Chester and Christ Church (Oxford) Cathedrals, and Tewkesbury Abbey, contain some of Scott's finest encaustic pavements and are described in more detail in the individual cathedral surveys (see Appendix, p.205).

Two churches with important encaustic pavements by Scott are St Mary, Beverley, 'one of the most beautiful parish churches of England' (Pevsner, 1972), restored in 1864–1867, and Holy Trinity, Hull, the largest parish church in England 'the interior of overwhelming length' (Pevsner, 1972). Exeter College Chapel, Oxford, contains what many regard as Scott's best interior, including a fine encaustic tile pavement. Scott summed up his attitude to restoration in 1857. He said

> Our churches have come to be cared for . . . the subsidiary arts of architectural sculpture and carving, decorative painting, stained glass, metal work, encaustic tiles and everything which is wanted for decoration of a building, are making advances more or less concurrently with architecture itself. We have, so far as churches are concerned, completely revived a lost style (*On the Present Position and Future Prospects of the Revival of Gothic Architecture*, Scott, 1857)

G.E. Street, another leading Gothic Revival architect, said during a lecture to the Ecclesiological Society in 1858 'We are medievalists and rejoice in the name; to us it implies a belief in all that is best, purest, truest in our art, and we deny altogether that it . . . implies any desire to refuse to this age what its history really entitles it to demand . . . The Pre-Raphaelites have taken their name . . . because they, as we, see in the name a pledge of resistance to false and modern

systems of thought and practice in art' (Street, 1858). Street removed many earlier floors to clear the way for his own pavements. At St Patrick's Cathedral, Dublin, Dunster Church in Somerset, and many others he showed considerable insensitivity to earlier work. Street favoured Godwin's tiles and used them in his new churches. St James the Less, Westminster, one of Street's most successful churches, has a richly decorated polychromatic interior. The floor tiles make an interesting foil to the impressive murals above the chancel arch by G.F. Watts, and to the stained glass by Clayton and Bell.

William Butterfield was selected by the Ecclesiologists to design All Saints, Margaret Street, London (1849–1859), as an exemplar of their ideals. It was partly financed and supervized by Beresford-Hope, their chairman. Charles Eastlake, author of *History of the Gothic Revival*, 1872, said of the interior, 'the secret of knowing where to stop in decorative work had still to be acquired'. Butterfield designed an encaustic pavement to complete the sumptuous decorative scheme.

Although the designs of individual encaustic tiles often came from medieval tiles, the complete pavements could never be mistaken for the originals. When Gilbert Scott restored the choir at Salisbury Cathedral the Restoration Committee ordered a new tiled floor, with tiles by Godwin, which was completed in 1876 (destroyed in c.1963). The designs for the encaustic tiled pavement in the chapter house were based on recordings made of the medieval tiles by John Carter, and, later, by Lord Alwyne Compton. The new

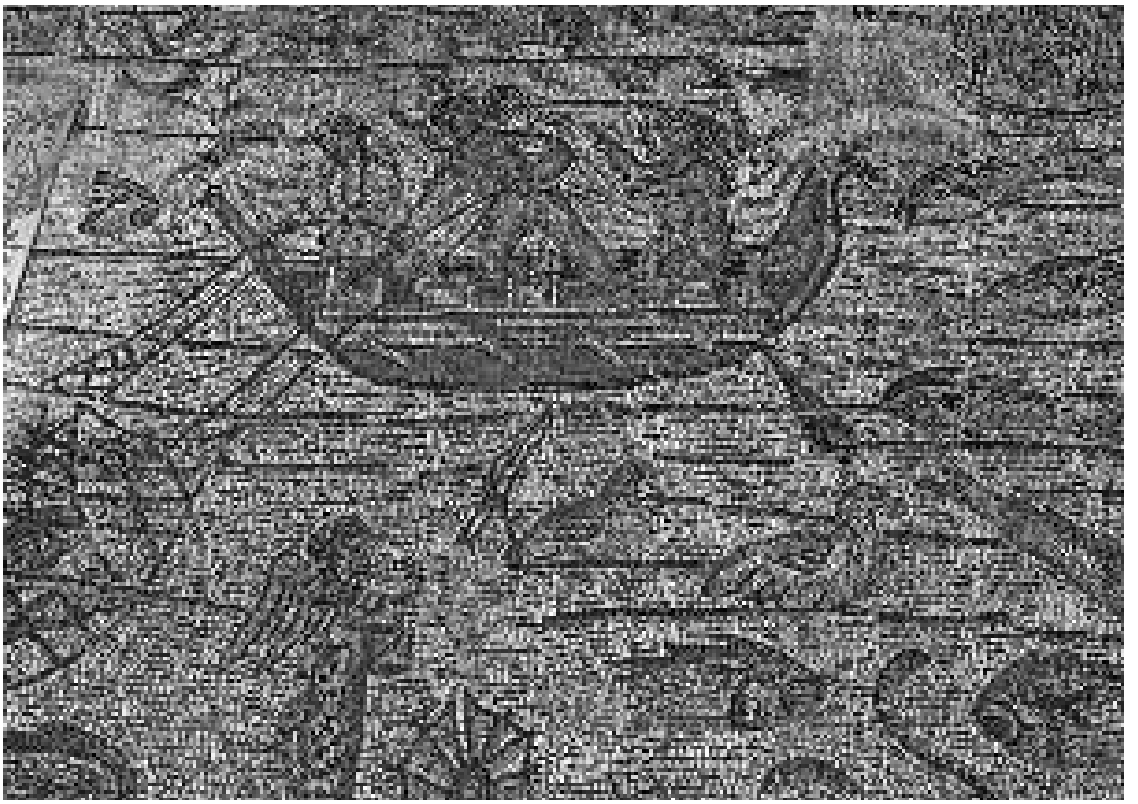

Figure 1.6 Basilica of Theodosius at Aquileia, Italy. Fourth-century AD Paleochristian mosaic pavement (Source: Fotometalgrafica, Bologna)

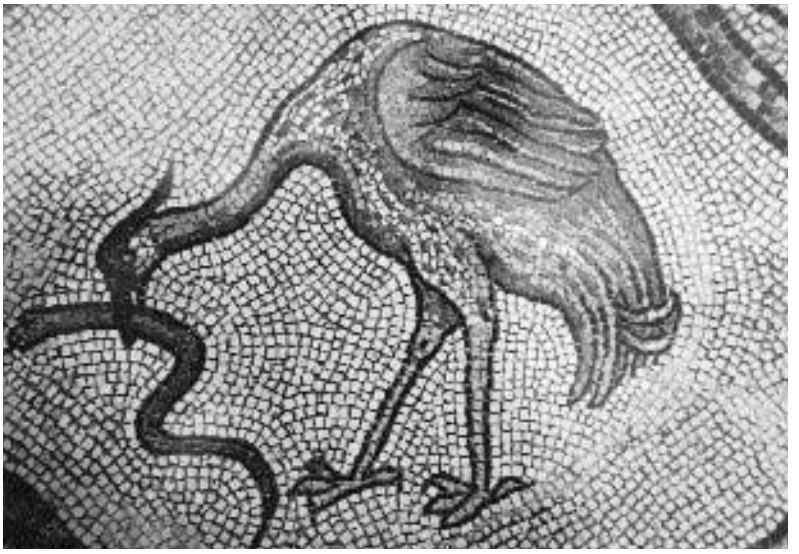

Figure 1.7 Basilica of San Marco, Venice, founded 976. Mosaic pavement, eleventh century (Photograph, by kind permission of Procuratoria San Marco, Venice)

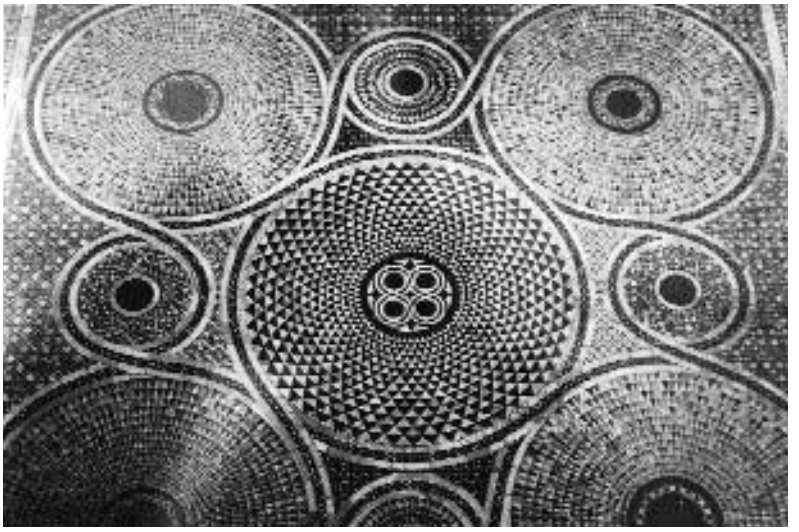

Figure 1.8 Basilica of San Marco, Venice. Mosaic pavement, cosmatesque design (Photograph, by kind permission of Procuratoria San Marco, Venice)

pavement was laid in 1856 during the restoration of the chapter house by Henry Clutton and William Burges (see Plates 3 and 4). The designs and overall layout were faithfully copied, but the floor lacks 'the luminosity and sparkle of the medieval tiles' (Norton, 1996). The colours are deeper and the glaze harsher. As with brasses, stained glass, sculpture, and other Gothic Revival furnishings, the inspiration came from the Middle Ages, but the mass produced replacements were entirely of their age.

1.3 Mosaic pavements

Mosaic pavements in geometric and pictorial designs, were one of the main decorative features of pagan temples and basilicas. The figurative designs were adapted by the early Christian church to illustrate Christian themes. One of the earliest and finest examples of these Paleochristian mosaics is in the Basilica of Theodosius at Aquileia, Udine. The mosaic pavement, dating from the fourth century AD, portrays Christ with the lamb, surrounded by

countless small cherubs, and Jonah emerging from the whale, with a sea of fishes and fishing putti (Figure 1.6). The geometrical framework linking this design bears some resemblance to the later Cosmati designs and the general composition to pagan precedents.

Another Paleochristian mosaic pavement, of the sixth century, from the Veneto, is S. Eufemia, Grado. Here the design is entirely geometric, composed of rectangles interlinked by borders of circles and lozenges, all in mosaic. The mosaic floor of *Sant'Ilario*, Venice of the ninth century, now in the Museo Correr, is composed of symbolic birds, contained within linked circles.

Owing to increased trade between Venice and Byzantium in the ninth century, the Veneto became one of the centres for Byzantine mosaics, and the use of porphyry and serpentine, well-known in the East, probably dates from this period. The cathedral, Santa Maria Assunta, Torcello, founded in 639 and rebuilt in 864–67, contains outstanding floors of mosaic and marble of the eleventh century (see Plate 7). Murano Cathedral, also in the Venice lagoon, has another wonderful Byzantine mosaic pavement (see Plate 8). The Basilica of San Marco contains the largest surviving areas of mosaic in the world (see Plate 6 and Figures 1.7 and 1.8). The floors are completely covered in mosaics, dating from the ninth century to the eleventh. These include areas of Cosmati design, some geometrical designs and may delightful mosaic compositions of biblical scenes, animals and birds.

Romanesque figural mosaic pavements, similar to Aquileia, are found in Apulia, in the Cathedral of Otranto of the eleventh century, where the floor mosaics represent scenes from biblical history, the Arthurian legend and signs of the zodiac. The Abbazia di Pomposa contains a superb mosaic floor dated 1026, which combines the mosaic figurative motifs of animals, contained within Cosmati motifs of a central quincunx and interlaced circular bands.

Leo of Ostia, the twelfth-century chronicler of Monte Cassino, reported that Abbot Desiderius had brought marble workers from Constantinople to lay the Cosmati mosaic floor for the new church at Monte Cassino in 1071, and to train Italian marble workers in a skill that had been lost to Italy for 500 years. It is clear that the Cosmati pavement at Monte Cassino, which was destroyed in 1720, but recorded, had a wide influence, and that it was itself influenced by Byzantine Turkish and Greek designs, notably at Bursa in the Mausoleum of Orham Gazi, in Hagia Sophia and St John Studion, both in Istanbul, all of the eleventh century. Similar designs are found in St Nicholas, Olynthus, in the Iviron Monastery, Mount Athos, and the Church of the Dormition, Nicea. All these examples were forerunners of the true Roman Cosmati work of the twelfth to the fourteenth centuries. Known as *opus Alexandrinum*, meaning ornamental paving of coloured marbles arranged in geometrical patterns, Cosmati pavements were composed of roundels, arranged in a guilloche or quincunx design. The guilloche consisted of circles of marble and mosaic, linked by curved bands of white marble to form a figure S. The quincunx was a figure 5, consisting of a central roundel surrounded by four smaller circles. Within this framework connected by bands and loops of white marble, a complex design of mosaic rectangles, diamonds, circles and squares was developed. The whole composition was arranged longitudinally, in order to lead the eye from the west end towards the high altar, for which it provided a setting. The design often continued on the altar steps.

The composition was entirely geometrical, of great complexity, and consisted of a large variety of ancient semi-precious stones. The contrast between the glittering many-coloured mosaics, often gilded, the large roundels of green or purple porphyry, and the brilliance of the white marble bands, created a distinctive effect. In many churches these precious materials were also applied to columns, pulpits, altar rails, episcopal thrones, tombs, baldachinos and ciboria. When the vaults were also decorated with mosaics, the effect was

brilliant. In some cases the guilloches and quincunx alternated with areas of rectangles or squares, themselves linked with white marble and filled with mosaics and pieces of coloured marble. A distinguishing feature of the central roundels was that they were usually sawn off sections of antique marble columns found lying among the classical Roman ruins. Other materials used included giallo antico, rosa persiano, and verde egiziano. Some of these had been mined in the Middle East, and came from mines closed by the fifth century AD. From these sources, they had been brought to decorate Classical Roman buildings, and so found their way into medieval churches. The beauty of the designs and the great antiquity of the materials gave these pavements a unique quality.

One of the earliest known examples of this technique dates from the ninth century AD, S. Prassede, Rome, in the chapel of San Zenone. From this the art of the Cosmati developed, and spread all over Italy and as far as Sicily, Greece, Turkey and Britain. The jewel-like Byzantine floors in the Capella Palatina and the Martorana in Palermo, Sicily, of the mid-twelfth century, have similarities with Cosmati work, but the angular composition also owes much to oriental precedents.

The Roman marble workers, or Cosmati, became active in Rome and in many other regions of Italy from the early twelfth century until the decline of the Papacy in 1300. With the exile of the Pope to Avignon much of their work ceased, although a few pavements continued to be made during the Renaissance. Some of the Renaissance floors in the Vatican, including the Sistine Chapel, are based on Cosmati designs. The craftsmen became known as the *Marmorani Romani* and were confined to a few families, of which Paulus and his family were the first. Others were Ranucius, Laurentius and Odoricus, who worked at Westminster Abbey. Each family developed its own distinctive style.

In Rome there are still many of these pavements, S. Maria in Cosmedin, S. Giovanni in Laterano, San Clemente, S. Maria in Aracoeli, S. Lorenzo Fuori le Mura, S. Maria in Trastevere (see Plate 9) and S. Maria Maggiore amongst them. Similar pavements were designed for S. Miniato in Florence, S. Francesco in Assisi, the Duomo in Spoleto, S. Martirio in Orvieto, and for churches in the Campagna (Glass, 1980). The cathedral of Anagni, in which Pope Alexander III canonized Edward the Confessor, and received the submission of Henry II after the murder of Thomas Becket, contains Cosmati pavements in the main church (restored) and in the crypt (original) and superb wall paintings on the crypt vaults. The pavement of S. Maria in Cosmedin, which resembles the Great Pavement at Westminster Abbey (see Plates 10a and 10b and Chapter 3), was designed by Paulus, founder of the earliest Cosmati family.

Abbot Ware, under whom the rebuilding of Westminster Abbey for Henry III took place, went to Rome, and to Anagni in 1258 to have his appointment confirmed by the Pope. At this time the Cosmati were at the height of their popularity and the Abbot must have seen examples of their work. He returned to Italy in 1267 and brought back Odoricus, a Cosmati craftsman to decorate the sanctuary, feretory and tombs of Edward the Confessor and of Henry III. The new pavements were completed in 1268. The ceremony of dedicating the new shrine of Edward the Confessor, and of installing his remains, took place in 1269. The Great Pavement, the most important Cosmati pavement north of the Alps, resembles the Roman examples in style, but some of the materials differ, Purbeck being substituted for white marble and glass tesserae for semi-precious stones. The centre of the quincunx is an immense onyx, marking the position on which the sovereign was crowned. It is thought to have come from ancient Egypt and resembles that of old St Peter's in Rome. The Lombardic letters surrounding it, some of which survive, dated the pavement to 1268 and recorded its creation by Henry III, Abbot Ware and Odoricus, sent from the Papal Court in Rome. The guilloche design contains tesserae of porphyry, giallo antico, and

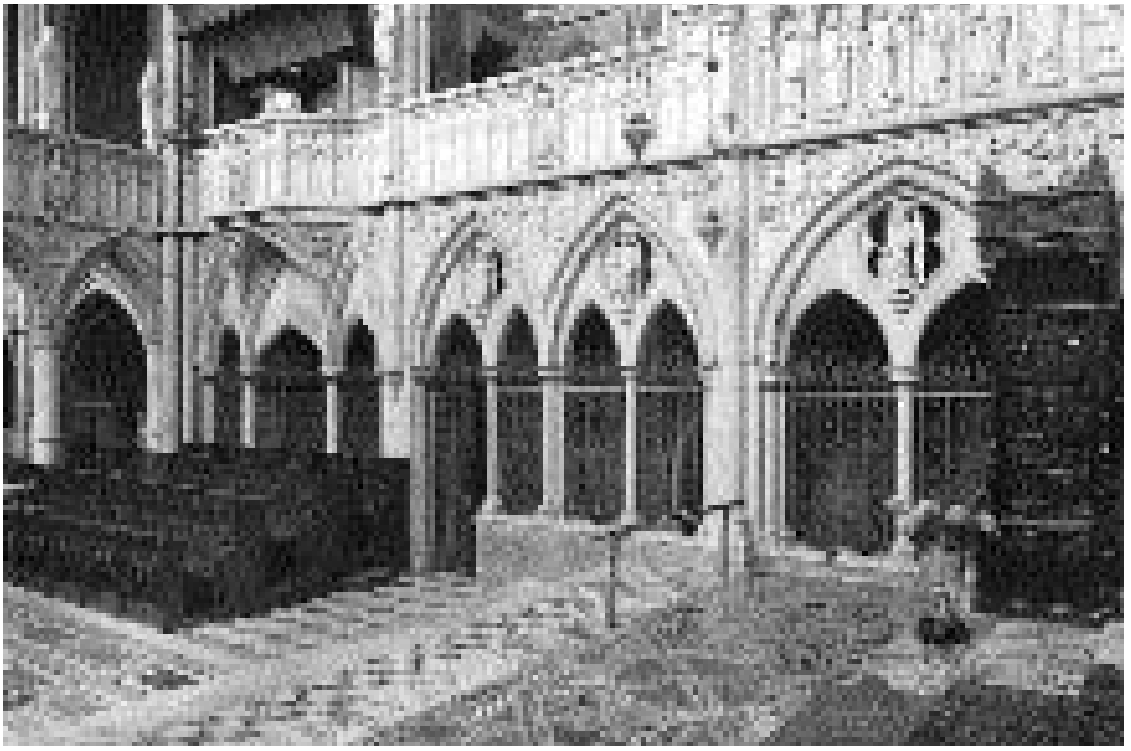

Figure 1.9 St Augustine's, Kilburn, London, 1870–80, by J.L. Pearson showing Cosmatesque pavement in the choir and sanctuary, and decoration by Clayton and Bell (Photograph, National Monuments Record)

coloured glass. Many of the materials were re-used from classical buildings in Rome, and some pre-dated them. The purple porphyry came from mines in Egypt, near the Red Sea, which were closed in the fifth century AD, and the green porphyry from Spartan quarries in Greece. The coloured glass is of Islamic origin, possibly made in Venice. The pavement was designed to enrich and frame the high altar. The Purbeck marble matrix provides a visually less satisfactory foil to the coloured mosaics than the white marble of Rome, and is deteriorating. The whole pavement was concealed by a modern carpet. It has now been reinstated as one of the glories of the Abbey, as Henry III intended (see Chapter 3).

The other outstanding thirteenth-century Cosmatesque pavement in Britain is the pavement in Trinity Chapel, Canterbury Cathedral (see Plate 11). This was laid in c.1220 to enrich the shrine of St Thomas Becket, and was possibly designed by Petrus Odoricus (Hutton, 1950). It consists of a geometrical pattern composed of small coloured marble tesserae, arranged in diamonds, squares and quatrefoils. The tesserae are smaller than at Westminster. The pavement also contains roundels of oolitic limestone with incised designs filled with red mastic, once representing virtues and vices, the signs of the zodiac, and the labours of the months. Some of the original pink marble paving also survives, near the site of the shrine (see Chapter 3, p.54).

1.3.1 Victorian mosaic pavements

The Victorian Cosmatesque revival centred round Gilbert Scott and John Loughborough Pearson, who knew the twelfth-century Cosmati floors from their travels in Italy. Pearson sketched Cosmati pavements in San

Lorenzo Fuori le Mura, in Rome, during his visit in 1874 and other medieval floors. Scott also restored the Cosmati pavement at Westminster Abbey. Both revived this technique to enrich the cathedrals and churches on which they worked.

Although their pavements lack the richness of the ancient stones, the fresh colours of the modern marble and the beauty of the designs lend a brightness and distinction to these interiors.

They also designed pulpits and baldachinos to complement the pavements, as the Cosmati families had done before them. Scott's fine Cosmatesque pavement in the chancel at Durham Cathedral and in the crossing at Chester Cathedral both make an outstanding contribution. Pearson's Cosmatesque pavements in the chancels of Bristol and Peterborough Cathedrals are equally successful as a foil to the sombre colours of the interiors. Although his intentions for the interior of Truro Cathedral were never fully implemented, owing to lack of money, his Cosmati pavements in the chancel and baptistery are impressive.

The remarkable church of Garton-in-the-Wolds, East Yorkshire, was restored and enriched by Pearson for Sir Tatton Sykes in 1856–1857. The Cosmatesque pavement in the chancel, and the mosaic floors in the nave, complete the decorative scheme of murals by Clayton and Bell. There are similar floors by Pearson in St Augustine, Kilburn, 1870–1880, one of his most spectacular and richly decorated churches (Figure 1.9). The Cosmatesque work enhances the rich sculptural decoration and wall paintings by Clayton and Bell. Pearson also designed a fine Cosmatesque pavement for his church St Stephen's, Bournemouth 1881–1898, regarded by Pevsner as the finest church in Bournemouth.

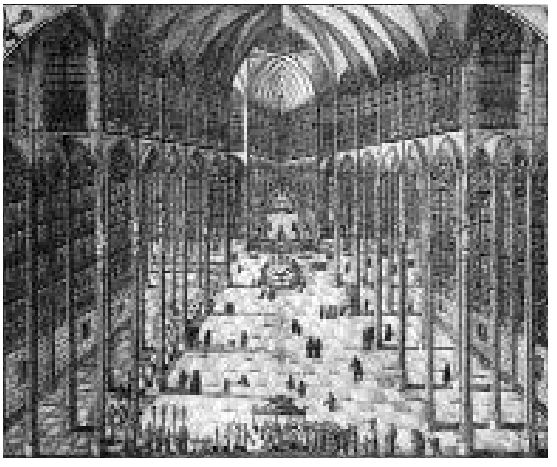

Figure 1.10 Cologne Cathedral, Germany. The nave, looking east, before repaving, by Joseph Maria Laporterie, 1795 (Photograph Dombau Archiv, Cologne)

The Italianate church of St Mary and St Nicholas at Wilton, Wiltshire, designed in 1841 by T.H. Wyatt and Brandon, has a fine nineteenth-century Cosmatesque pavement and decoration which complements the genuine Cosmati work on the medieval twisted columns. These were reputedly bought in Italy by Sir William Hamilton in 1768, given to Horace Walpole, and bought by Sidney Herbert for the church in 1842. William Butterfield designed, for one of his largest and most successful churches, Babbacombe in Devon (1867), a fine Cosmatesque pavement and pulpit, the floor tesserae mixed with encaustic tiles.

Westminster Cathedral by J.F. Bentley, 1895–1903, also contains Cosmatesque pavements. In the chapel of St Paul is a pavement by Edward Hutton, to a design adapted from the Capella Palatina in Palermo, Sicily. Hutton also designed the Cosmatesque pavements in the sanctuary and central crossing at Buckfast Abbey, Devon, in 1942–1943. Some of the most extensive nineteenth-century mosaic pavements are those designed by Auguste Essenwein for Cologne Cathedral, Germany, from 1880 (see Plates 12–14 and Figure 1.10). These floors also contain areas paved with geometric designs in marble. See Chapter 13.

1.4 Marble pavements

Marble floors were common in ancient Rome and marble has continued as one of the most

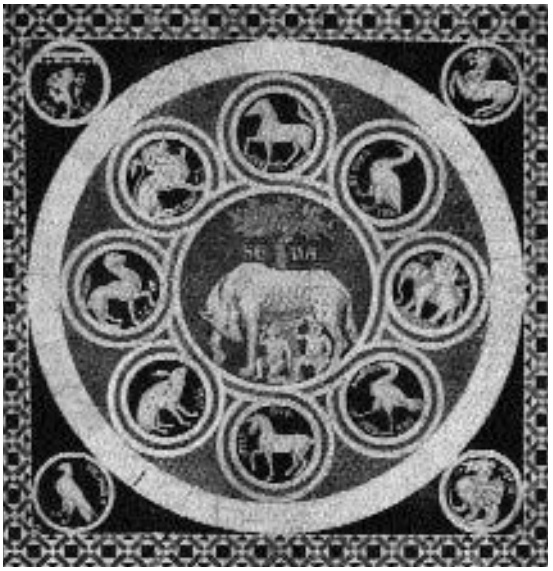

Figure 1.11 Siena Cathedral, Tuscany, Italy. 1284–1296, by Giovanni Pisano has one of the richest Renaissance floors in Italy, constructed between 1349 and 1547. Artists include Pinturiccio and Beccafumi. Subjects range from biblical to allegorical themes. Some sgraffito panels. Above, Romulus and Remus, restored by Leopold Maccari in the nineteenth century (Photograph, Dombau archiv, Cologne)

Figure 1.12 Lucca Cathedral, Tuscany, Italy. Fifteenth-century marble pavement (Photograph, Jane Fawcett)

widespread flooring materials in Italy up to the present day. St Peter's, Rome, has a bold geometric pavement of contrasted coloured marble in the nave and aisles, while the Renaissance floors of the Vatican are paved with many superb designs including several Cosmati variants. The fictive cube design, giving a three-dimensional impression, was used as early as 1566 in the chancel of Palladio's San Giorgio Maggiore in Venice, and later throughout Europe in both churches and secular buildings. It was also adapted to marquetry inlay.

Santa Maria della Salute, Venice, by Longhena, 1630–1687, has a fine marble perspective pavement under the dome (see Plate 15). Siena Cathedral, Tuscany, 1284–1296, by Giovanni Pisano, has some of the finest Renaissance floors in Italy, by artists including Pinturiccio and Beccafumi. It was constructed between 1349 and 1547 (see Figure 1.11).

Another fine marble pavement of the fifteenth century can be found in Lucca Cathedral, Tuscany (see Figure 1.12). It contains panels of geometric patterns, including fictive cubes.

In northern Europe, imported marble was expensive and its use limited. Decorative stone floors were used in the new east end of Bishop Rodger's Old Sarum Cathedral in the twelfth century, where both documentary evidence, and the survival of a small patch of chequered stone pavement indicate the original appearance. St John Hope, excavating the site in 1913 (St John Hope, 1913), records that the new east end was extensively paved with contrasting blocks of white Chilmark and green Hurdcote stone. These colours are still visible today. The chapel floor was paved in a pattern of interlacing circles, of different material. It is now thought that the transepts were similarly paved (Norton, 1996). St John Hope also excavated pieces of verde antico and red porphyry. There is the possibility, therefore, that a Cosmati pavement existed here as well. If so, it was the first in England, as the Cosmati pavements at Westminster Abbey, Canterbury Cathedral and St Augustine's Abbey, Canterbury, were begun after it was destroyed.

Inigo Jones on his return from Italy in 1614 was one of the first to introduce marble floors into his classical buildings. One of the earliest was in the Queen's House at Greenwich (see Plate 46). Sir Christopher Wren designed the

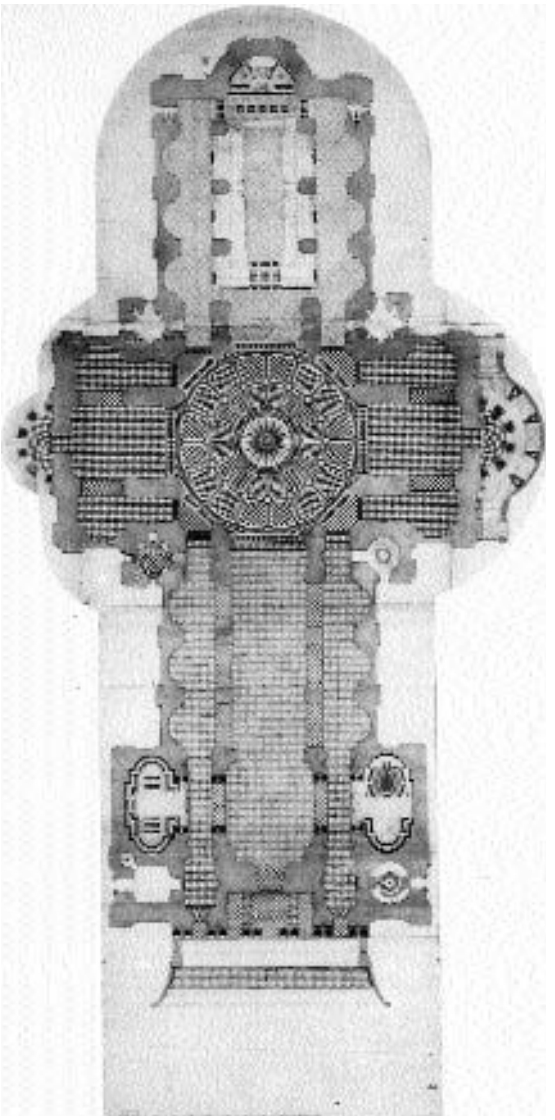

Figure 1.13 St Paul's Cathedral, London 1675–1711 by Sir Christopher Wren. Paving plan, 1708 completed 1710. Drawing by Dickinson. From *The St Paul's Cathedral Collection of Wren Drawings*, on deposit with the Guildhall Library, Corporation of London (Photograph, Geremy Butler; copyright, Guildhall Library.)

noble black-and-white chequered pavement in St Paul's Cathedral as the culmination of this spectacular classical interior (Figures 1.13 to 1.16). Under the dome lies the fine circular pavement divided into quadrants, with a central star and, at intervals, brass roundels inscribed with Tudor roses and hearts.

Figure 1.14 St Paul's Cathedral, London. Wren's chequered marble floor today; the Nave from the Triforium (Photograph, Philip Way)

The chancels of many of Wren's City of London churches also had chequered marble floors (see Plate 17). The chancel of St Magnus the Martyr is an example; the nave and aisles paved with freestone flags with many ledgers. St Benet's, Paul's Wharf, is another of the few of Wren's City Churches in which the floors have remained intact.

The chequered marble pavement in the choir at Westminster Abbey was laid c.1690 in memory of Dr Busby, the famous Headmaster of Westminster School. In the Henry VII chapel a similar floor was laid in 1699, possibly by Wren who was Surveyor to the Fabric from 1699–1723. It was altered in the 1760s after the burial of George III in the royal vault. Many Hanoverian burials are commemorated by inscribed white marble lozenges.

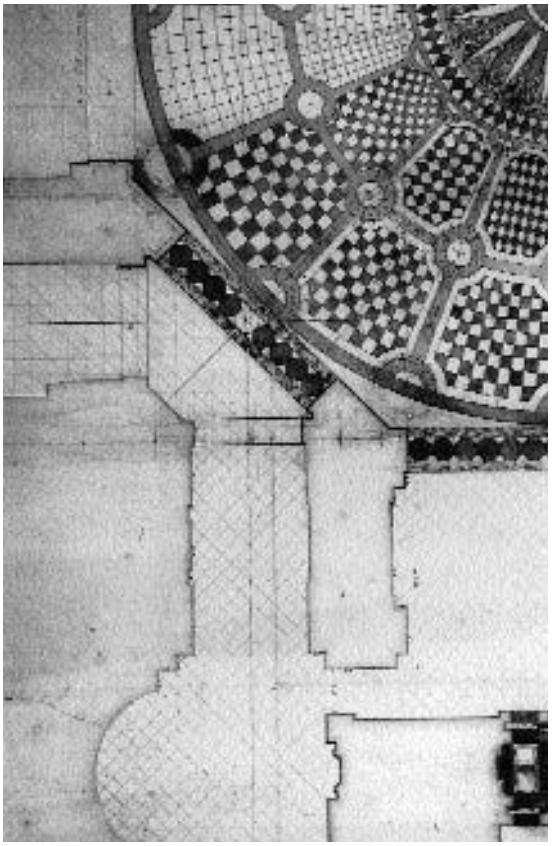

Figure 1.15 St Paul's Cathedral, London. Designs for the southeast quarter plan of the crossing, by Wren, showing position of brass grilles. From The St Paul's Cathedral Collection of Wren Drawings, on deposit with the Guildhall Library, Corporation of London. (Photograph, Geremy Butler; copyright, Guildhall Library)

Figure 1.16 St Paul's Cathedral, London. Brass grille with marble surround, central feature of Wren's crossing design (Photograph, Jane Fawcett)

The chequered floor in the choir at St George's Chapel, Windsor, also containing a royal burial vault, is of a similar date. The black and white marble pavement in the Chapel Royal at Hampton Court of 1711 is based on a design by Serlio, popularized by d'Aviler in his *Cours Complet d'Architecture* of 1691 (see Chapter 14). Nicholas Hawksmoor's superb fictive cube marble pavement in the choir at Beverley Minster of 1716–1720 gives the illusion of a three-dimensional pavement (Figure 1.17). This design, already well known in Italy in the sixteenth century, was published by d'Aviler and later, by Batty Langley in *Ancient Masonry* in 1736 (see Chapter 14).

Many medieval floors were destroyed when cathedrals were repaved during the late seventeenth and eighteenth centuries, work often necessitated by damage caused during the Civil War. The nave of York Minster was

Figure 1.17 Beverley Minster Choir showing Nicholas Hawksmoor's fine pavement of 1716–1720 (Photograph, Pitkin Guides)

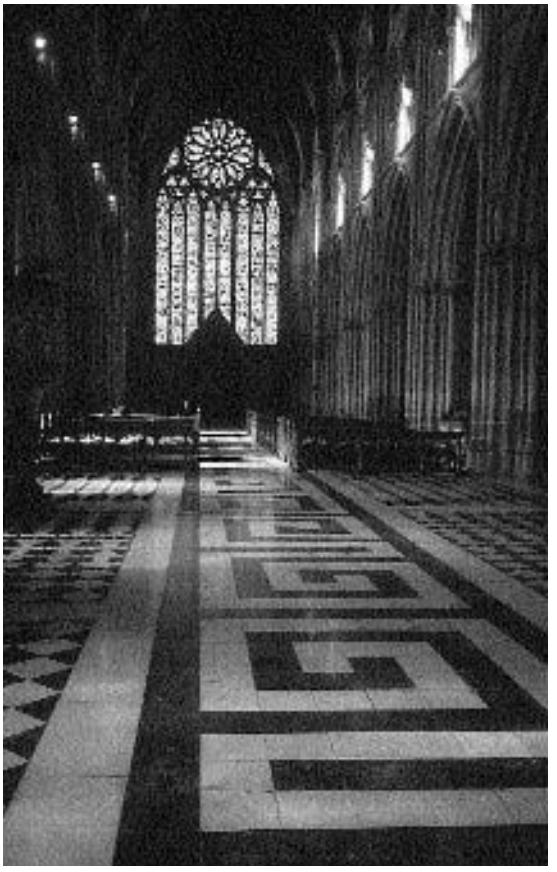

Figure 1.18 Worcester Cathedral, Hereford and Worcester. Marble pavement, c.1874, designed by Sir George Gilbert Scott. (Photograph, Jane Fawcett)

repaved to designs by William Kent and Lord Burlington in c.1730 with contrasted local freestone and black marble, much of it later replaced in slate, in a fine geometric pattern of roundels and squares. A new pavement, based on Burlington's design, has recently been laid in the choir (1991–1995).

As marble was considerably more expensive than stone its use was usually confined to the choir. *The Builder's Dictionary* of 1734 estimates the cost for 'paving or laying with Free-Stones . . . squared all to a size . . . 12d or 14d a foot . . . but if well polish'd . . . then they may be worth 15d or 16d per foot . . . Paving with marble is of all other the most beautiful, of which there are several sorts . . . This sort of pavement is valued from 2s to 3s per square foot and upwards according as 'tis well laid and polish'd'.

Throughout the eighteenth century chequered marble was popular and many eighteenth-century churches, including St George's, Hanover Square, by John James of 1721, and All Hallows, London Wall, by George Dance of 1765, still retain their marble floors. James Wyatt laid a marble chequered floor at Lichfield Cathedral from 1788, only to be replaced by Scott's encaustic tiles. The use of marble was somewhat eclipsed in the mid-nineteenth century by the availability of encaustic tiles, which were cheaper and, to the Victorian taste, more colourful. Gilbert Scott, however, laid a superb chequered marble pavement alternating with a huge key fret design in the nave, aisles and transepts at Worcester Cathedral (Figure 1.18). These lead the eye up to the richer encaustic pavements in the chancel.

Many of the floors at Ely Cathedral were replaced by Gilbert Scott between 1861 and 1869. Bacon, Scott's Clerk of Works, recorded that formerly 'the floors between the piers which support the twelve arches on each side of the nave were mostly made up of monumental slabs from which the brasses had long been removed'. Lord Alwyne Compton, then Bishop of Ely, offered a Cosmatesque scheme based on the Great Pavement at Westminster Abbey, but this was rejected in favour of Scott's design. This involved levelling the nave and aisles, and laying a pavement composed, according to Bacon, of Imperial red and green Irish marble squares, on a base of Mansfield, Purbeck and Alwalton, with large roundels and a patterned border. It is still there today. Scott repaved the floor under the west tower with a labyrinth design, and the southwest transept floor with Purbeck and Mansfield red stone, laid in alternative lines and panels (Boddy, 1994). At Winchester Cathedral, a version of the famous octagon and square design in freestone with black marble lozenges was already in the chancel by 1817, and remains there today.

Figure 1.19a Hall of San Martino, the Roman labyrinth, Lucca, Italy

Figure 1.19b Amiens Cathedral, Northern France. Fine marble geometric pavement, containing a representation of a labyrinth, destroyed in 1820 and reinstated in 1894 (By kind permission of the Direction Régionale des Affaires Culturelles de Picardie)

Chequered marble pavements also appear in many of the churches of the Low Countries and are featured in the fine architectural interiors of the sixteenth and seventeenth centuries. Antwerp Cathedral, painted by P. Neefs the Elder (1577–1657), is a good example.

Many of the Spanish cathedrals have decorative marble floors. Seville, 1402–1506, the third largest cathedral in the world, has outstanding floors. The black and white marble floor in the nave contains ledgers, including a large medieval grave slab in front of the sanctuary, dated 1403. The magnificent treasury is paved with a fictive cube perspective design. The Royal Chapel, the Chapel of S. Isidoro, the Sacristy of the Chalices and the main Sacristy all have fine chequered pavements, of different designs. The chapter house floor is composed of many coloured marbles in a complex radiating design under its dome, derived from Michelangelo's design for the Capitol in Rome. All are small architectural gems.

In France, at Chartres Cathedral, spanning the full width of the nave, is a massive circular stone labyrinth of c.1200. The central roundel, plundered at the Revolution, originally represented Theseus and the Minotaur. The sun strikes this point on 21 June. Pilgrims traversed the labyrinth on their knees as a final act of penance, the distance covered reputedly equalling the length of the Via Dolorosa. The labyrinth is of the same diameter as the great west rose window above.

Figure 1.20 Ely Cathedral, Cambridgeshire. North choir aisle. Tournai marble slab. Possibly Bishop Nigellus, d.1169 (Photograph, Jane Fawcett)

To the Greco-Roman world the labyrinth represented the unrolling of life towards the final exit into the kingdom of death. This pagan symbol was adapted by Christianity, to represent the course of life leading to paradise. The history of the labyrinth is obscure, and it is not known how the Cretan legend from Knossos became adapted to Christian use. It was first recorded on a Cretan coin of 67 BC. An ancient slate tablet found at Pylos, Greece, was engraved with a similar design. A labyrinth was found in the ruins of Pompeii, with an inscription in Latin. There are several at the Roman site of Italica, near Seville, and one on the Roman pavement at Cormerod, Switzerland. At Lucca, in Tuscany, the Hall of San Martino contains a remarkably intact Roman carving of a labyrinth (Figure 1.19a).

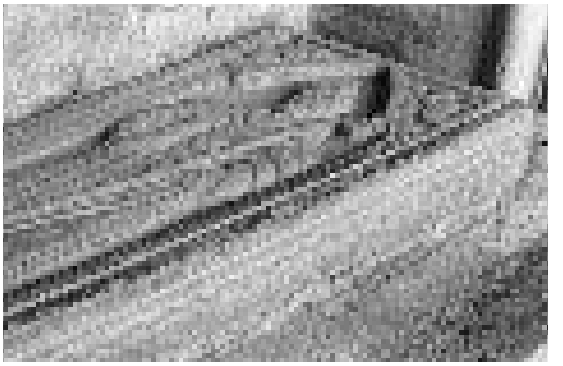

Figure 1.21 Exeter Cathedral, Devon. Lady Chapel. Purbeck marble slab, possibly Bishop Bartholomeus, d.1184. One of the earliest Purbeck sculptures in the country (Photograph, Karen Taylor)

Some of these floor labyrinths were square rather than circular. The earliest Christian example is in Algeria in the basilica of Reparatus El-Asnam, of 328. San Vitale in Ravenna has a sixth-century floor labyrinth measuring 6 m across. It also occurs in Cremona Cathedral (eleventh century) and S. Maria in Trastevere, Rome (twelfth century).

In France, the cathedrals of Sens, Arras, Reims and Auxerre had stone labyrinths in the nave of similar date and design to Chartres. They were destroyed during the Revolution. In 1820 the octagonal labyrinth in the nave at Amiens was destroyed, but reinstated in 1894 (Figure 1.19b). The octagonal labyrinth at Reims, destroyed in 1778, was reinstated more recently (Villette, 1984). All were intended, as with the Cosmati pavements, to lead the eye towards the high altar.

1.5 Ledger stones and effigies

The term ledger referred, in the Middle Ages, to a large volume which lay flat on a shelf, reading desk or ledge, or, if it was a service book, on an altar (see Chapter 5). When used to refer to ledger stones, it meant slabs lying flat on the ground, or covering a tomb, rather than on a wall.

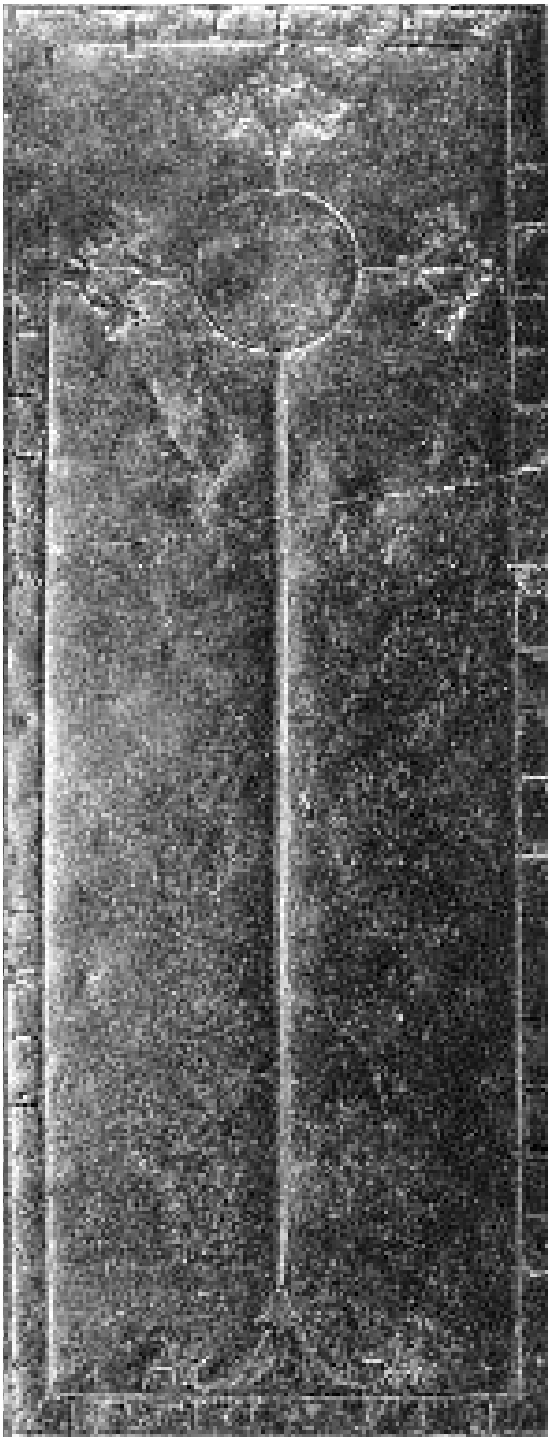

Figure 1.22 Exeter Cathedral, Devon. Bishop Quivil, d.1291 who completed the Lady Chapel. Ledger stone with foliate cross (Photograph, Karen Taylor)

Figure 1.23 Exeter Cathedral, Devon. Ledger stone. Thomas Gayre d.1583 (Photograph, Karen Taylor)

The ancestry of ledger stones can be traced back to the late eleventh century, when carved stone coffin lids were sunk into the floor. These were simply decorated with a foliate cross, with a sword for a man at arms, an anvil for a blacksmith or a sickle for a farmer. During the twelfth century incised coffin shaped slabs in Tournai or Purbeck marble developed, and a few have survived. One of the earliest Tournai slabs is to Bishop Nigellus, d.1169, at Ely Cathedral. An angel is depicted carrying his soul to heaven (Figure 1.20).

The broken Tournai coffin slab, possibly to Bishop Remigius, d.1140, at Lincoln Cathedral, is decorated with a tree of Jesse. This is a posthumous monument.

Two magnificent effigial coffin lids, one in Tournai and one in Purbeck marble, in Salisbury Cathedral are to Bishop Roger, d.1139, with a fourteenth-century replacement head

and an unusual leaf border. The other is possibly to St Osmund, d.1099, a figure under a canopy with formalized drapery, the effigy and lettering of the twelfth century. Both are very fine, and both were moved from Old Sarum.

One of the earliest Purbeck effigies is to Bishop Bartholomeus, d.1184, in the Lady Chapel at Exeter Cathedral (Figure 1.21). The figure lies under a trefoiled gable, with angels in the spandrels. Another to Bishop Simon of Apulia, d.1223, also a life-size figure under a canopy, lies in the next recess. The incised marble slab to Bishop Quivil, d.1291, who completed the Lady Chapel, lies on the floor centrally (Figure 1.22). The grave slabs to Bishop Brewer, d.1244, Bishop Bitton, d.1307, Bishop Turberville, d.1559 and Bishop Allein, d.1570, also at Exeter, have been identified, but retain no inscriptions. The indent to Bishop Berkeley, d.c.1327, contains a circular matrix for the brass demi-figure.

At Peterborough Cathedral there is a tomb slab to Abbot Benedict c.1195, and effigies to four Abbots c.1195–c.1225.

Equally remarkable, and possibly the earliest incised slab, is that to Bishop Bitton II, d.1274, at Wells Cathedral, a figure under a trefoiled gable.

At Westminster Abbey, in the cloisters, lie three damaged effigies of abbots, Lawrence, d.1173, Gilbert Crispin, also twelfth century, and William de Humez, d.1222. There are, of course, many further effigies of the period, but these are on tomb chests, and not on, or near, the floor. Slabs incised with a portrait were the precursors of memorial brasses rather than of ledger stones.

The nave of Chichester Cathedral has a rare survival of medieval paving, dating from the twelfth century and showing medieval and later ledger stones and indents of brasses inserted into surviving areas of medieval lozenge-shaped paving. It is a superb medieval jigsaw (see Plate 18).

The ledger had three purposes; to identify the place of burial; to close the grave while providing access to it; and to record an inscription, which, if carried out with beautiful lettering and accompanied by a coat of arms, could be a work of art. It could also commemorate an entire family, and often did so. It was not in itself a monument, but was sometimes related to a nearby wall monument.

Figure 1.24 Kilkenny Cathedral, Ireland. Ledger stone to James Purcell, d.1552, and Johanna Shortals. Black letter inscription. Sixteenth century (Photograph, Jane Fawcett)

During the late sixteenth century the new merchant and middle classes copied the aristocracy by paying for intra-mural burials inside churches. These graves were capped with ledger stones. By the early seventeenth century ledgers of black marble, about seven feet long and three feet wide, capping graves, became widespread. They were usually aligned to the east, with an incised inscription recording the name, date and occasionally the occupation of the deceased. Some also contained small pictures in relief.

Figure 1.25 Pershore Abbey, Hereford and Worcester. Ledger stone, damaged during replacement of steps in c.1860 and uncovered during excavations, 1995–1996 (Photograph, Kevin Blockley)

Figure 1.26 Thaxted Parish Church, Essex. Armorial ledger stone to Charles White, d.1679 (Photograph Jane Fawcett)

The ledger continued to be one of the most popular forms of sepulchral monument until the sinking of new vaults and graves in churches ceased with the 1852 Burial Act. The aesthetic significance of the ledger is dependent on the stone, the quality of the lettering, historical interest of the person commemorated, the literary value of the inscription or the heraldic interest.

Ledgers were made of various materials, white, black or variegated marble, or more often Purbeck or local stone. Some were inlaid with brass inscriptions, as at Bath Abbey, or with white marble lozenges, as at Bristol and Chester Cathedrals. They provide valuable evidence of middle-class occupation of the English village or town from the close of early modern England to the beginning of Queen Victoria's reign. From them we can learn of the uses to which churches were put during the seventeenth, eighteenth and early nineteenth centuries, and the occupation and status of the deceased. Their importance in the study of local history has still to be assessed, as the evidence they provide has been largely overlooked.

In cathedrals and abbeys they often commemorate leading churchmen and members of the local aristocracy, frequently decorated with heraldry, coats of arms and elaborate inscriptions. Those in churches provide an important record of middle- and working-class inhabitants.

There is an important incised ledger, a figure framed by a canopy, to Bishop-elect William Bell 1332–1342, formerly in St

Figure 1.27 Westminster Abbey, London. Cloisters, east walk. Mrs Aphra Behn, playwright, d.1689, recut in 1970s (Photograph, Jane Fawcett)

Figure 1.28 St Paul's Cathedral, London. 1675–1711. Sir Christopher Wren. Crypt. Tony Webb, Master Carver re-entering inscription to George Dance, d.1825, on worn ledger stone, in 1995 (Photograph Philip Way)

Andrew's Cathedral, Fife. It has been moved to the Cathedral museum for safety. There is also a large Tournai marble matrix in the presbytery, and other ledgers, all in poor condition, owing to exposure to the weather.

In the fourteenth and fifteenth centuries incised slabs included a marginal inscription, giving the name, age and often occupation of the deceased, with a chamfered edge. There is an unusually fine medieval alabaster ledger in the Lady Chapel at York Minster to Thomas de Castell, d.1403, Vicar Choral. The ledger in the south transept of St Mary Redcliffe, Bristol, to William Coke, servant of William Canynge, c.1440–1470, who paid for the building of the clerestory and nave vaults, has a black letter marginal inscription and is decorated with a dagger. Nearby, with a black letter inscription, still filled with lead, is a ledger with an incised cross to John Blecker, who endowed a chantry chapel in 1434.

Kilkenny Cathedral, Ireland, contains the most important collection of medieval floor monuments in the country (Figure 1.24). A number of them are inscribed with the tools of the trades of the deceased. These include Donatus Brin, a carpenter, showing adzes, an auger and carpenter's square, William Hollechan, weaver, who has a fly-shuttle and Richard Clouan, shoemaker, who has knives, an awl and part of an Irish brogue.

In the Lady Chapel at Rochester Cathedral, the ledger to Frederick Hill, d.1759, contains a picture of himself as the good Samaritan, on horseback. Hill 'provided for his majesty's sick and wounded seamen at this port'.

Many of the seventeenth-century ledgers capped earth graves. At St John's, Thaxted, several of those buried in the chancel were unable to afford a ledger, and their graves were marked by floor tiles recording their initials and the year of death. An unusually interesting range incorporating figures, heraldry, skull and crossbones, putti, foliate borders and rather crude lettering in relief, exists at St Magnus Cathedral, Kirkwall,

Orkney. They mostly date from the seventeenth century.

Eighteenth-century ledgers were often laid directly on top of brick graves, and this explains the chips seen round the edges of the stone, where it has been lifted to permit another burial. When the floor of the church of St Augustine-the-Less, Bristol, was excavated the area beneath the floor was found to be covered with brick graves, without an inch between them, and during the nineteenth and early twentieth centuries services had taken place above a sea of coffins. At Westminster Abbey the under-floor area was entirely filled with burials, with many more in the cloister garth.

Occasionally, ledgers were located close to the individual's pew, and church wardens' account books confirm this. Ledgers were also used as the capping-off stone to the stairwell entrance of subterranean burial vaults.

Ledgers encapsulate the entire development of the art of lettering from the earliest Gothic to the finest script designed by craftsmen. The earliest letter forms, dating from the thirteenth century, are in Gothic or black letter, derived from the medieval scribes of Europe. There are many versions of Gothic lettering on ledgers. The earliest had marginal inscriptions, often in relief. Some of the early Gothic lettering is deeply impressed. There are examples at Exeter Cathedral and at St Mary Redcliffe, Bristol, where the original infill between the letters is still visible.

Gothic lettering was superseded by Italic, derived from Italian writing masters of the sixteenth century. Roman letter forms, also common on ledgers from the seventeenth century onwards, came from classical Roman script dating back to the first century AD. Copper plate was widely used in the eighteenth and nineteenth centuries, and the more austere Clarendon is also found on many eighteenth- and nineteenth-century ledgers.

The quality of lettering was dependent on the skill of the letter cutter, and the amount of money spent. John Le Neve, in his series of volumes on church monuments, compiled in the mid-eighteenth century, provided some information on the leading sculptors and letter cutters, and on the ledger stones on which they had worked. The Stantons of Southwark, a renowned family of sculptors, gave Le Neve a list of their ledger stones and wall monuments. From this Julian Litten identified six ledgers to the Abdy family in the north aisle at Kelvedon Church, Essex, all provided by the Stantons at the same time. The three female Abdys had white marble ledgers, with coats of arms in lozenge-shaped shields. The three males had ledgers of black Tournai marble, with their coats of arms on square shields. All six Abdys are commemorated on

Figure 1.29 Campo Santo, Pisa, Italy, often regarded as the most beautiful cemetery in the world. Effigial ledger slab (Photograph, Jane Fawcett)

Figure 1.30a Stenkyrka, Gotland, Sweden. Incised slab to Jacobus et Butuidus d.c.1500. The slab proved too short, so the hat was placed in the corner. Stenkyrka, or stone church, c.1030, was the oldest of ninety-three churches on Gotland, all in use in 1891 (From *Incised Slabs on the Continent of Europe*, 1891, by Rev. Creeny. Published privately. Reproduced by courtesy of Society of Antiquaries, London)

Figure 1.30b St Stefan's Cathedral, Vienna. Fifteenth-century relief in the north choir aisles, taken from the Old Churchyard (Photograph, Jane Fawcett)

a wall monument in the south aisle, not designed by the Stantons.

During the eighteenth century, ledgers were increasingly associated with wall monuments, and the lettering on both often came from the same craftsmen. The lettering on the Grinling Gibbons monument to Archbishop Lamplugh in York Minster is identical to that on his ledger stone nearby.

The outstanding concentrations of medieval ledgers occur at Exeter and Lincoln Cathedrals, many with marginal inscriptions in Latin or medieval French. These cathedrals also have a rich collection of ledgers of other periods. Wells, Salisbury, Gloucester, Canterbury, Winchester and Bristol Cathedrals and Tewkesbury Abbey have important ledgers

Figure 1.31 St John's Cathedral, Valetta, Malta. Floor entirely covered with ledger stones in coloured marble, mostly dating from the seventeenth century, many to Grand Masters of the Order of the Knights of St John. These fine ledgers are being damaged by stiletto heels, and a conservation programme is in progress (Photograph, Mario Mintoff, Photocity, Valletta)

dating from the seventeenth century or earlier. Westminster Abbey is outstanding for the number of ledgers, the historical importance, and variety of inscriptions to the many royal, ecclesiastical and public figures commemorated. Some individual ledgers are identified in the cathedral floor studies (see Appendix) and many more are located in *Cathedral Floor Damage Survey* (Fawcett, 1991), covering forty-four cathedrals and greater churches.

The development of heraldry on ledger stones has still to be studied. Many coats of arms, being in high relief, have been obliterated even more catastrophically than carved inscriptions, and little research has been done.

It is doubtful if any heraldry survives on ledgers before the sixteenth century. Its use to record the coat of arms of the deceased increased dramatically on the reinstatement of the monarchy with Charles II. During the late seventeenth and eighteenth centuries heraldic ledgers were used by the nobility, and in the early nineteenth century they were very common, particularly in cathedrals, where many of the nobility were buried.

It is surprising that ledgers have been so little studied by archaeologists and historians, although they provide a rich source of historical information. The rate of loss of inscriptions is alarming. Many that were still legible when the ICOMOS survey was completed in 1991 have already disappeared under the remorseless grinding of feet, and many cathedrals and most churches are still without adequate records. As a result of resurfacing, liturgical reforms and wear and tear, it is

estimated that at least one-third of the original stock of ledgers has been destroyed, leaving an estimated 165 000 in Britain.

On the Continent, there is a rich heritage of ledger stones, effigial slabs and incised slabs, with many regional variations. Ledgers in France, Holland and Belgium resemble those in the UK. In Italy, Germany and Austria, however, ledgers often contain a lifesize effigy in high relief. The inscribed ledger slabs recorded by the Reverend Creeny in 1891 document a remarkably wide range of styles, but many have now disappeared (Figures 1.30a and b).

In St John's Cathedral, Valetta, Malta, a World Heritage Site, an unusual floor composed of ledgers of coloured marble in high relief, commemorates many of the Grand Masters of the Order of St John, dating from the seventeenth century (Figures 1.31 and Plate 16). See Chapter 13.

1.6 Monumental brasses

The earliest brasses were made in the late twelfth or early thirteenth centuries in the area between Dinant on the Meuse and Cologne. The material, known as latten, from which monumental brasses were made was an alloy of copper and zinc. The copper was mined in the Hartz Mountains, and the zinc obtained from calamine ore, a form of powdered stone, found near Aachen. Calamine ore, or zinc carbonate, was ground up and mixed with charcoal and pieces of copper. When heated, the zinc alloyed with the copper and formed brass. This was melted and poured into shallow stone moulds and left to set. Until the sixteenth century, when suitable materials were found in England, all the brass was imported from the Cologne area. The earliest known brass in Europe is at Verden, near Bremen. It commemorated Bishop Yso von Wilpe d.1231 and is six feet long, made in one large piece.

The making of incised tomb slabs was on the increase in western Europe from the

Figure 1.32 Hildesheim Cathedral, Germany. Bishop Otto de Brunswick, d.1279 (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

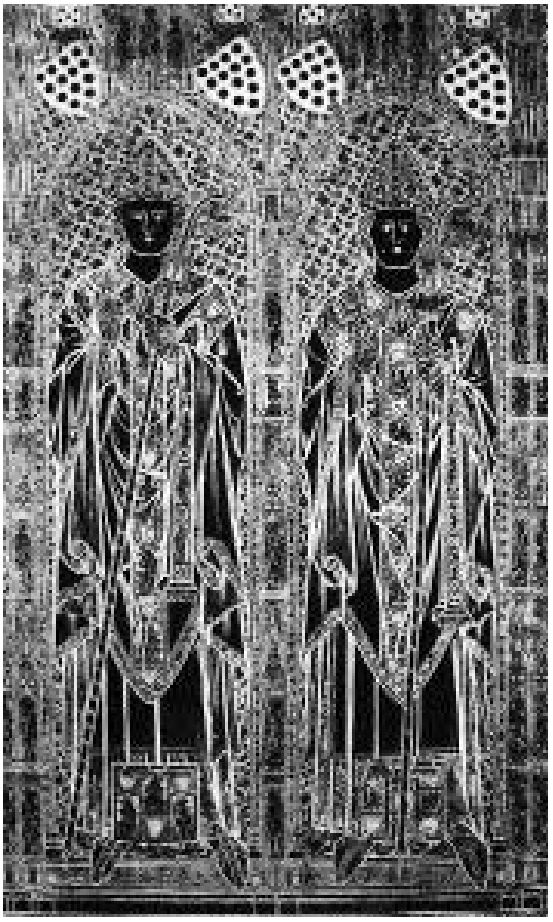

Figure 1.33 Schwerin Cathedral, Mecklenburg, Germany. Bishops Ludolph d.1339 and Henry de Bulowe d.1347. Four brothers, all bishops, were commemorated by double memorial brasses in Schwerin (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

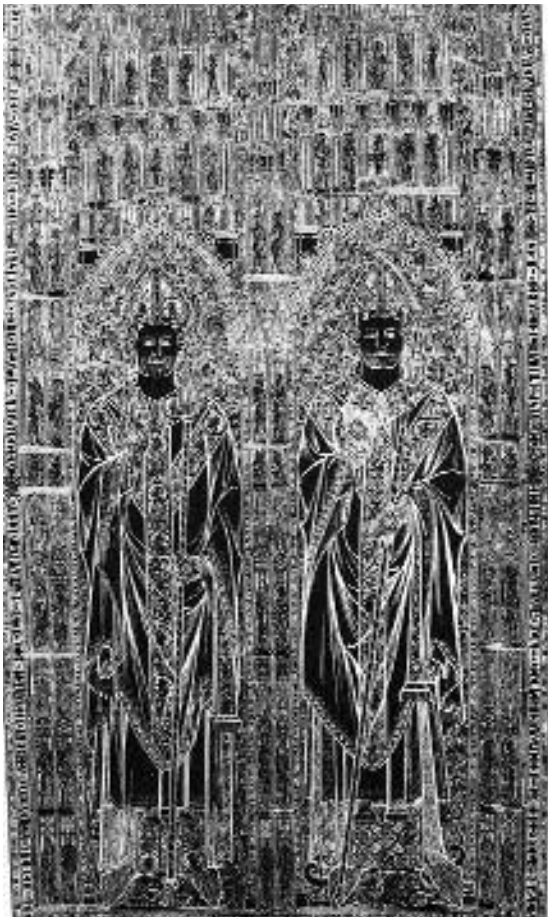

Figure 1.34 Lübeck Cathedral, Germany. Bishops Burchard de Serken, d.1317, and John de Mul, d.1351, commemorated by a double brass, one of the finest examples of monumental engraving (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

twelfth century, particularly in the Tournai area lying between France and Flanders. By the mid-thirteenth century a technique had developed for filling the incised figure on the slab with brass, and so the production of Tournai marble slabs with inlaid brasses developed. The marginal inscriptions were also filled with brass.

Many brass founders were established in the Tournai area by the early fourteenth century. Tournai marble was quarried at Cherq or Antoing nearby throughout the medieval period. It was black or dark grey. The marble slabs were prepared, the brass inlay inserted on site, and the finished products sent out. For large brass figures the sheets of brass were secured on the back of the slab by soldering. Brasses were often made in sections. They represented full length figures, sometimes with canopies, saints and marginal inscriptions.

Tournai brass slabs were brought to Britain during the fourteenth century and a few examples survive: in Scotland at Dundrennan Abbey (an indent of a man in armour c.1320),

Figure 1.35 Lübeck Cathedral, Germany. Bishop Bertram Cremen, d.1377 (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

Figure 1.36 Nordhausen Hospital of Chiriaci, North Germany. Jacob Capillan, d.1395 (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

in St John's, Perth (man and wife c.1360) and in Whithorn Priory (mitred figure c.1360); in England at Winchelsea, Sussex, Boston, Lincolnshire and, best of all, at Higham Ferrers (Lawrence de St Maur, Rector, d.1337). At Durham Cathedral the Tournai indent of Bishop Louis de Beaumont c.1333 has a border of saints and angels. It was one of the largest brasses in the country, thought to have been made to silence his critics, because he was said to be exceedingly unpopular.

During the thirteenth century brasses became an increasingly popular form of monument, both in Britain and on the Continent. The earliest English brasses date from about 1257, developed from incised coffin-shaped slabs. They were in the form of long crosses, sometimes with a Lombardic inscription, and often with a sword or chalice indicating the occupation of the deceased. The earliest of these, in the feretory at Westminster Abbey, commemorates the children of William de Valence, Margaret and John, 1276–1277. The inscription is in brass Lombardic letters (Page-Phillips, 1969).

English brasses reached the highest peak, both for quality of design and variety, under the influence of Flemish craftsmen in the late thirteenth and fourteenth centuries. Regional styles were developed in workshops in London, Norwich, Bristol and York.

The brass to Bishop Wyville, d.1357, in Salisbury Cathedral is outstanding. The bishop looks out of Sherborne Castle, which he had recovered for the church from the Earl of Salisbury; rabbits and hares represent Bere Chase, territory for which the bishop was also fighting. Another important fourteenth-century

Figure 1.37 Carlisle Cathedral, Cumbria. Chancel, brass to Bishop Bell, d.1496

Figure 1.38 Exeter Cathedral, Devon. Bishop Bitton, d.1303, hypothetical reconstruction by John Carter, Antiquary, in the late eighteenth century

ecclesiastical brass is to Bishop Trillack d.1360 at Hereford Cathedral. The bishop lies under a cusped arch with an ogee gable. William Ermynd, d.1401, a priest at Castle Ashby, Northamptonshire wears an unusual cape embroidered with portraits of saints.

Ecclesiastical brasses are rare (see p.38), but there are many early indents; at Ely Cathedral Bishop William de Luda, d.1298, at Wells Cathedral Bishop Walter de Haselshaw, d.1308, at Hereford Cathedral Bishop Thomas de Cantilupe, d.1282, who was canonized in 1320, at Peterborough Cathedral Abbot Godfrey de Croyland, d.1329, at St Albans Abbey Abbot Rich, d.1335, and at Canterbury Cathedral Archbishop Stafford, d.1443, and Archbishop Dean, d.1501.

Figure 1.39 Sir Roger de Trumpington, Cambridgeshire, d.1289. The second oldest military brass in England (By courtesy of the Cambridge Medieval Brass Rubbing Centre)

Figure 1.40 Sir George Felbrigg, Playford, Suffolk, d.1400 (By courtesy of the Cambridge Medieval Brass Rubbing Centre)

The beautiful indent by the pulpit at Wells Cathedral may have commemorated Countess de Lisle d.1484. She wears a mitred head-dress and lies beneath a canopy. The row of forty-three enormous indents in the north and south choir aisles at Lincoln make an overwhelming effect.

During the course of the fourteenth century the export of finished brasses from Flanders

Figure 1.41 Ghent, Belgium. Jacques and Joosyne Symoens, d.1576 (from a *Book of Facsimiles of Monumental Brasses on the Continent*, Reverend Creeny, 1884. Published privately. Reproduced by courtesy of the Society of Antiquaries)

increased, promoted by the Hanseatic League. Brasses were shipped to Scandinavia, Germany, France, Spain and England. Some of these were made for merchants working for the league. The focus for this manufacture appears to have been Ghent or Bruges, using supplies of Tournai marble shipped along the river Scheldt. One of the finest fourteenth-century ecclesiastical Flemish brasses is to Abbot De la Mere, d.1396, in St Albans Abbey.

Some of the most impressive brasses to survive are the English military brasses. They were usually made in London, set in Purbeck marble, often with Lombardic lettering. Sir John Daubernon c.1272, Stoke D'Abernon, Surrey, is the oldest brass in England. Sir Roger de Trumpington c.1289, Trumpington, Cambridgeshire (Figure 1.39), Sir Robert de Bures, c.1302, Acton, Suffolk and Sir John de Creke (and his wife) c.1330, Westley Waterless, Cambridgeshire, are all full-length figures in chain mail, all exceptionally fine. Two of the best English fourteenth-century brasses, by the same craftsmen, possibly working for the court at Westminster, are of Sir John de Wautone, d.1347, at Wimbish, Essex, and Sir John Gifford, d.1348, at Bowers Gifford, Essex. Two exceptional fifteenth-century military brasses are to Sir Thomas de Beauchamp, Earl of Warwick, d.1406, a friend of Edward III (and his wife), in St Mary's, Warwick, and Sir Thomas Chaucer, d.1436 and his wife at Ewelme, Oxfordshire. He fought at Agincourt and was the son of Geoffrey Chaucer.

It is possible to date many military brasses to within ten years. From the reign of Edward I to the seventeenth century brasses are an important source of information on the development of armour.

Similarly brasses provide an excellent record of women's costume. Dame Jane de Cobham, d.1298 in Cobham, Kent, one of a fine group in that church, is one of the earliest English brasses of a woman. Lady Margaret Camoys d.1310 at Trotton, Sussex wears a dress covered in heraldic shields. Margaret Cheyne, d.1419 at Hever, Kent, wears a horned head-dress, her head supported on a magnificent embroidered cushion carried by two angels. Margaret Peyton d.1484, Isleham, Cambridgeshire, has a richly embroidered dress and a butterfly head-dress, and Susan Kyngeston d.1514 at Childrey, Oxfordshire, has a pedimental head-dress with a pomander on a cord round her waist.

Although the merchants portrayed on brasses are not so easily datable, they do, nevertheless, provide a record of civilians'

Figure 1.42 Lady Katherine Howard, St. Mary, Lambeth, London, d.1535. She is depicted wearing a heraldic mantle (By courtesy of the Cambridge Medieval Brass Rubbing Centre)

clothes. There are interesting brasses at Northleach, Gloucestershire, to an unknown wool merchant c.1400, his woolsack at his feet, and to William Scors d.1447, a tailor, whose feet are on a pair of crossed scissors. Northleach also contains seven brasses of wool merchants with their wives, mostly of the fifteenth century.

Trinity Chapel, St John the Baptist, Cirencester, contains twelve brasses to wool merchants and their wives. William Prelatte d.1462 and his two wives, and Richard Dixton, d.1438, both in armour and both wool merchants, paid for the building of Trinity Chapel. Reginald Spycer, d.1442, also a wool merchant and also a contributor to the cost of building the church, lies there with his four wives. Another remarkable and coherent group are the twelve brasses to the de Cobham and Brooke families, Lords of the Manor, in St Mary Magdalene, Cobham, Kent. These include Joan de Cobham, c.1310, Joan, Lady Cobham. d.1433, with her two husbands Sir Reginald Braybrook, d.1405 and Sir Nicholas Hawberk, d.1407, both in armour, all framed by canopies. The brasses are lined up in two rows across the chancel.

During the fifteenth century the figures became smaller, children appeared grouped below their parents, with inscriptions at the base. The Tudor period saw more brasses produced than at any other period, but many were made to standard designs, and the artistic quality gradually declined. Inscriptions, formerly in Latin or medieval French were now in English, the figures were on the whole less well-drawn and the composition often crowded.

Heraldry provides useful evidence for the dating and identification of brasses. Heraldic shields were often mounted separately on the corners of the stone slabs to which the brasses were fixed. Tabards worn by Tudor knights carried heraldic devices. The brass to Sir Ralph Verney, d.1547, and his wife at Aldbury, Hertfordshire, was decorated with elaborate heraldry.

By the mid-seventeenth century brasses had almost disappeared, although there was a brief renaissance during the Gothic Revival. The distribution of brasses in Britain was largely determined by the accumulation of wealth. There is a concentration in the south and southeast, fewer in the west country and the north, and almost none in Wales, Scotland and

Figure 1.43 Westminster Abbey, London. Nave, brass to John Loughborough Pearson, d.1897. Surveyor to the Fabric, 1878–97. Designed by W.D. Caroe. (Photograph, National Monuments Record)

Ireland. St Albans Abbey, which was one of the richest and most influential religious foundations in England, contains an exceptional concentration of brasses, mostly ecclesiastical, in the chancel and choir aisles. Westminster Abbey, a royal foundation, is also richly endowed with both secular and ecclesiastical brasses.

Thousands of brasses were destroyed during the iconoclasm that began with the Reformation when, as supporters of the old religion, bishops and abbots were targets for destruction. Weaver's *Ancient Funeral Monuments*, written in 1631, gives an account of the iconoclasm set in motion by Henry VIII. 'Marbles which covered the dead were digged up, tombes hack and hewne apeeces . . . inscriptions or epitaphs, images or representations of the defunct broken, erased, cut or dismembered.' Of brasses he says 'for greediness of the brasse, or for that they were thought to bee Anti-christian pulled out from the sepulchre and purloined'.

Worse followed. During the Civil War, Cromwell's Commissioners were sent out to purge the churches of idolatrous furnishings, and very few brasses survived the destruction. Out of many thousands, it has been estimated that only about 2000 remain in Britain, and on the Continent, where the rate of loss has been even more catastrophic, it is estimated that even fewer have survived. A considerable number of brass indents still exist, however. These matrices, often of immense size, retain the imprint of the original brass, sometimes the studs with which it was fixed, and occasionally fragments of the brass itself. They are the ghosts of medieval brasses, impressive works of art that bear witness to our destructive past.

Interest in medieval brasses was aroused in the early nineteenth century by the writings of the antiquaries Richard Gough, John Carter and John Britton, all well-known for their work on medieval buildings. Gough and Carter collaborated over *Sepulchral Monuments*, published in 1786. Carter was also renowned for his accurate drawings of cathedrals for the Society of Antiquaries, opposing the restorations of James Wyatt. Britton, through his publication of accurate drawings of cathedrals, was influential in awakening interest in Gothic buildings. They also published brass rubbings; some of these

early impressions are now in the British Museum and the Society of Antiquaries. John Sell Cotman published engravings of brasses in Norfolk and Suffolk in 1819. Horace Walpole, always ahead of public opinion, commissioned a memorial brass to Bishop Walpole of Ely to give a medieval flavour to the cloisters at Strawberry Hill where it was laid in c.1755 (Meara, 1983).

By 1837 brass rubbing had become a popular activity among the cognoscenti. Before long, the Ecclesiologists decided to promote, not only the study of brasses, but their reproduction. They recommended brasses or incised slabs as suitable memorials, and maintained that 'brasses are the most fitting kind of monument that . . . could be adopted'. They promoted Pugin and Hardman, and also Waller of London, who offered a large double brass with canopies for £60. Most of Waller's designs were based on medieval examples. *The Gentleman's Magazine* of 1848 noted that 'in the revivals of Pugin and Waller, ancient examples had been principally copied'.

Pugin, in his *Apology for the Revival of Pointed or Christian Architecture in England* (1843) argued in favour of brasses as suitable monuments. He was also concerned over suitable costume for his figures. 'To represent persons of the present century in the costume of the fourteenth, is little less inconsistent than to envelope them in the Roman toga.' He felt, however, that women's clothes of the period were acceptable for brasses and so also were those of the clergy. He recommended that for private gentlemen a figure brass with 'a long cloak, disposed in severe folds, would produce a solemn effect', while 'for the humbler classes, a cross, with the instruments of their trades or crafts . . . would be sufficient'. Pugin became a friend of John Hardman of Birmingham, and together they set up a medieval metal-working business, and produced a wide range of Gothic metalwork for churches, including brasses. Both Hardman and Pugin were Roman Catholics, and their collaboration, which began in 1838, was fruitful, both financially and artistically, and many brasses were made to Pugin's design. Although Pugin died prematurely in 1852, Hardmans continued as one of the leading manufacturers of memorial brasses. In 1970 the Hardman studios were burnt down and their metal-working business ended. As well as new brasses, Hardmans and Wallers made a lucrative income out of the restoration of medieval brasses, a technique which continues to this day.

Some of Pugin's designs were of elaborate crosses with shields of arms, vine scrolls and Gothic pinnacles and canopies. The brass at Grafton Underwood, Northamptonshire, to Lady Gertrude Fiztpatrick, d.1841, who kneels under a cathedral-like structure is remarkable. Others were of life-size figures, of which Mrs Sophia Sheppard, d.1848 in Holy Trinity, Theale, Berkshire, is an impressive example. The lettering was, of course, always Gothic.

The brass to George Basevi, d.1845, at Ely Cathedral is a good example of a coloured Victorian brass designed and made by Wallers. Basevi stands under a canopy, holding his design for the Fitzwilliam Museum, Cambridge. The marginal inscription describes his death from a fall from the scaffolding while restoring the Cathedral. The fine life-size brass to Robert Stephenson, d.1859, designed by Gilbert Scott and made by Hardmans, in the nave at Westminster Abbey, is a similar composition though without the canopy. Both represent the bold approach which characterized many Victorian brasses. Hardmans also made the brass to Sir Charles Barry d.1860 in Westminster Abbey. It incorporates the ground plan of the Palace of Westminster and the Victoria Tower. Scott's own memorial brass, also in the Abbey, designed by G.E. Street, contains the small seated figure of Scott within a more complex composition, including a cross and allegorical figures.

The impressive brasses in the crypt of St Paul's Cathedral to Lord Leighton d.1896 and Sir John Millais d.1896, both designed by Norman Shaw, contain noble lettering with coats of arms in high relief on black marble slabs, while the brass to Sir Arthur Sullivan d.1900 has a border of birds in foliage, a spray

of leaves and a lyre. They all make a strong statement for this new, and relatively short-lived art form, which, while taking its inspiration from the traditions established in the Middle Ages, nevertheless developed techniques and styles of their own. One of the most recent brasses was designed by Christopher Ironside to commemorate the Earl and Countess of Mountbatten at Westminster Abbey (1985). The replication of brasses for brass rubbing has created a new industry, and a new public interest in the subject.

The distribution of brasses is much better documented than ledger stones. The Monumental Brass Society are carrying out a nation-wide survey which will provide valuable new information on condition and survival. Some important cathedral brasses are documented in ICOMOS *Cathedral Floor Damage Survey* (Fawcett, 1991) and also in the attached floor studies (see Appendix).

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2

The archaeology of church and cathedral floors

Warwick Rodwell

Church floors differ greatly from those of secular buildings in two principal ways. First, in a secular building – whether public or private – a floor of unified construction and finish is the desired norm, at least within the confines of a single space. A dais or other special feature may provide the exception. This unified approach is, however, seldom found in medieval and later ecclesiastical buildings, where a variety of materials, finishes and levels is common. Secondly, a secular floor, once laid, tends to remain more-or-less undisturbed throughout its lifespan (or did, prior to the advent of modern under-floor services). By contrast, church floors have been constantly tampered with in response to natural wear and tear, changes in liturgical fashion, and the demands of indoor burial. Consequently, ecclesiastical floors can display a bewildering complexity and, in the majority of instances, their histories are only interpretable through systematic archaeological investigation.

2.1 The church floor: a developing structure

2.1.1 Materials and laying techniques

The earliest floors tended, except in buildings of outstanding quality, to be of simple, locally available materials, such as clay, gravel or chalk: they are loosely termed 'earth' floors. In Anglo-Saxon and Norman churches a single layer of flooring material, 5–10 cm in thickness, could cover the entire building, and a unified approach was therefore usual at this early date. However, there was more to laying an earth floor than simply dumping cartloads of raw material and spreading it about. In the case of clay, the material was first puddled, then spread and tamped down. Gravel was not laid loose, but mixed with brickearth, clay, or another binding agent, and laid damp. Chalk floors often consisted of two merged layers, the lower comprising small rubble, and the upper a slurry of pulverized chalk which cemented the whole together and provided a dense surface.

A few early churches were floored with a screed of weak concrete, after the Roman fashion, the ingredients being lime mortar and crushed brick (*opus signinum*). Remnants of such floors have been uncovered at Reculver (Kent) and elsewhere. There are also a few recorded instances of an in situ concrete or tessellated floor of Roman date being reused, where a church was built on the site of a more ancient structure (e.g. St Helen-on-the-Walls, York). Lime concrete, containing gravel, chalk, ironstone or other stone chips as an aggregate, was also used for flooring in a few late Saxon and Norman churches. Although little evidence remains, it seems that concrete flooring was selectively used in the more important parts of

churches that were themselves of higher-than-average parochial status.

Concrete should not be confused with mortar. The common 'mortar' floor was widespread in late Saxon and medieval churches. Its creation was partly adventitious and partly deliberate. Huge quantities of lime mortar were employed in the construction of medieval churches, both as a matrix and for rendering. Mixing was often carried out within the building, and materials stockpiled there. Consequently, by the time the walls were complete, and rendered, significant deposits of lime mortar and aggregate had usually accumulated over the working area, filling ground hollows and spreading across the interior as a series of interleaved and discontinuous layers. Uniformity was then achieved by spreading a thin layer of mortar over the whole, thus deliberately forming a floor surface. The remains of these composite mortar floors are frequently encountered in church excavations, and are invariably of irregular thickness. They may be as little as 1 cm but, where underlying irregularities have been filled, the thickness may be 10 cm, or more.

The occasional appearance of gypsum as a medieval flooring material was largely confined to special purpose uses, principally the construction of masons' tracing floors, as at Wells and York (Colchester and Harvey, 1974; Harvey, 1969). Gypsum does not fare well in damp conditions, and thus tended to be used at a high level. The same applies to lime-ash and other forms of post-medieval 'plaster' flooring. A few examples still survive in churches, in belfries and upper chambers, as in Bristol and Lichfield Cathedrals.

Extensive use of dressed stone paving was rare in churches before the thirteenth century, and was then found only in the major buildings. The case of Canterbury Cathedral is probably exceptional: there the eleventh-century nave was floored with thick limestone blocks embedded in a prodigious quantity of mortar (p. 64). The case of Kellington (North Yorkshire) is more likely to be typical of stone flooring of that date. The single-celled church was built on a rough pavement of pitched limestone rubble, with weak mortar used sparingly to fill the interstices (Atkins *et al.,* 1991; Mytum, 1993).

Good stone paving was in use in major churches in the twelfth century, and from the middle of the thirteenth century onward decorative ceramic tiles became increasingly popular in ecclesiastical structures of all types and sizes. These tiles varied from c.10 cm to 20 cm square, were mostly glazed and were laid on a bed of lime mortar. Where the ground was uneven it might be levelled with a layer of gravel or small rubble, before screeding with coarse lime mortar; the tiles would then be set in a finer mortar, as a second operation. Alternatively, if the existing floor was fairly even, a tile pavement could be laid on a thin bed, without the need for a preparatory layer. A reasonably fine grade of mortar had to be used for fixing tiles because the same material also filled the vertical joints between them. Narrow jointing is impossible with coarse mortar.

Their relatively light weight meant that clay tiles were suitable for flooring upper chambers in churches and monastic buildings, and some notable examples survive in these locations. Mostly, tiles were laid over the rubble-filled pockets of stone vaults, as at Westminster Abbey (Muniment Room), or Lichfield Cathedral (Library) (see Plates 20 and 21), but they could also be laid on suspended timber floors. The Muniment Room at Salisbury Cathedral has a thirteenth-century tile pavement laid on top of a boarded timber floor, the whole being above the sacristy (Norton, 1996).

The vogue for decorated floor tiles waned in the sixteenth century, and plain tile paviours became fashionable. These generally fell within the size-bracket of c.20–30 cm square, and many were plain red; others were grey or buff in colour. Their popularity continued into the nineteenth century, particularly in poorer churches. Paviours were frequently laid on a single bed of medium-coarse lime mortar, and the visible joints were consequently often wide. In the seventeenth and eighteenth

centuries many of the more affluent churches were floored with neatly cut and finely jointed stone paviours, 30 cm square, or larger. The paviours were often laid diagonally, and a black and white chequered arrangement was preferred. Imported marbles were employed in the best work, but local alternatives were numerous. Thus, at Lichfield Cathedral in the late seventeenth century alabaster and 'cannel coal' were used to simulate a black-and-white effect (Figure 2.1). Invariably, a graded rubble bed was carefully prepared and screeded to receive pavements of this type, and fine lime putty was used for jointing. Similar, or more meticulous, preparation was necessary for nineteenth-century Cosmati, *opus sectile* and mosaic work, as seen at Peterborough, Bristol and Truro Cathedrals.

2.1.2 Layers and levels

Floors wear out with the passage of time, especially where soft materials have been used, and periodic replacement is inevitable. Moreover, most ancient churches have been rebuilt, enlarged, or internally reordered. In some cases such changes have been both frequent and drastic, and these processes all give rise to alterations in the materials, layout or levels of floors. In the Middle Ages areas of worn flooring were often repaired by simply laying a new surface on top of the old, be it puddled clay or a glazed tile pavement. The introduction of unevennesses, inclines and small steps was not, in the average church floor, of serious concern. Where a step or incline inconvenienced the placement of furniture, a localized levelling operation might take place.

The natural corollary of these processes was a gradual rise in floor levels inside buildings. Pier bases of arcades diminished visibly in height, plinths disappeared from view, thresholds were raised and doors trimmed in sympathy. In many a medieval church floor levels had risen by between 15 and 50 cm (sometimes more) by the mid-nineteenth century. Where a total rebuild occurred, as in London after the Great Fire of 1666, 1.5 m or more may separate the earliest from the latest floors. Older rebuilds could have the same effect: in Bath Abbey the thirteenth-century tile pavement of the nave lies 1.8 m below the present (mid-sixteenth century) floor.

Nowadays we tend to think of floors as being truly *level*, with vertical changes neatly accommodated by the introduction of steps. But this concept stems substantially from Victorian attitudes to architectural precision and tidiness. In medieval churches, minor changes in level were not generally punctuated, and floors were simply ramped according to need. Excavation commonly reveals that the primary floor in a church closely mirrored the natural lie of the land: a slope in any direction could be acceptable (Rodwell, 1989a, 114–16). Thus in the Saxo-Norman nave at Hadstock (Essex) an incline of nearly 50 cm from east to west was recorded, while across the transepts there was a fall of c. 75 cm from south to north (Rodwell, 1976). St Peter's Church at Barton-upon-Humber (Lincolnshire) was also built on ground which fell away to the north. While the effect might just have been noticeable in the Norman aisle-less church, it became much more apparent when aisles were added. The bases of the north arcade piers were constructed 60 cm lower than their counterparts on the south, and the overall floor slope across the width of the high medieval church approached 1 m. Even in churches of the first rank an unlevelled interior could be tolerated. Thus the floor of the late twelfth-century choir at Lichfield Cathedral sloped from north to south by 30 cm, a reflection of the underlying natural topography. In a large building differences in level of this order are imperceptible to the eye, but are revealed through survey.

In many cases, sloping floors have been 'corrected' during restoration, but some dramatic examples still remain: thus at St Peter-in-the-Wood, Guernsey, the rise from the west door to the altar is at least 1.5 m. It was the installation of large timber furniture that

needed to stand upright – choir stalls and pews – that usually occasioned the levelling of floors. The choir floor at Lichfield was levelled in the fourteenth century, presumably to accommodate the new Gothic stalls (Rodwell, 1993).

2.2 Burial beneath the floor

Undoubtedly the most major disruption sustained by church floors was through the practice of internal burial; this effectively ceased in the mid-nineteenth century. Under Anglo-Saxon Canon Law burial was forbidden within the body of a church, and was thus confined to side-chambers (*porticus*), but the century following the Norman conquest saw a gradual increase in both clerical and lay interments in nave and chancel. At first they were few in number and unpretentious in aspect. Early indoor burials tended to be marked by flat stone slabs, incised with a cross and set flush with the existing floor. Graves were neither deep (average 50–60 cm) nor intended for multiple occupancy, and thus the disturbance to the interior of a church occasioned by burial was both physically limited and infrequent. In the thirteenth century the rapid rise in the popularity of the chantry led to the proliferation of indoor burial, including burial of whole families.

The effect on floors was dramatic. First, it meant that they were continually being dug up, especially in urban churches. That, in turn, introduced instability and surface irregularities in floors, as well as a patchwork of materials used to make good the damage and to mark the burial. Practically, it is impossible to excavate a grave, inter a corpse, backfill with loose soil, and reinstate a floor surface as it was previously: however well this is done, the whole will subside, and the floor will distort. The only effective way to counter this is to line the grave shaft with masonry or brick and to cap it with stone at floor level. Although this structural treatment of graves was initiated in the sixteenth century, it did not become common until the eighteenth century. A few medieval interments were housed in stone constructions, and more were in stone coffins. The coffin might be covered with a slab that was itself set at floor level, thereby obviating subsidence. Most of the decorated pre-Reformation grave-covers surviving in churches today were originally floor-level coffin lids. Many brass matrices may have been likewise.

The desire to provide graves with permanent markers led progressively to more elaborate floor slabs, upstanding monuments and funerary enclosures. These all had profound effects on flooring arrangements. Flat grave covers, whether plain, incised or inlaid with brass, could be walked over and thus they did not necessarily alter the circulation pattern within a church. The same applies to graves marked only by a rectangle of distinctive tiling, or a small commemorative plaque.

Medieval grave covers with moulded edges stood proud of the floor and thus introduced minor circulation obstacles, even if they were raised by only 15 cm. By contrast, chest tombs and all other types of monument which stood on the floor were fundamental obstructions and, if several were grouped together, they could effectively define a space with a specific related function, e.g. a family chapel. That, in turn, tended to give rise to piecemeal flooring arrangements.

After the Reformation, indoor burial increased in popularity, not just for clergy and distinguished patrons, but for whole families. The effect on floors was catastrophic. Rich families caused crypts and burial vaults to be constructed under churches, and in so doing large areas of ancient flooring were torn up, destroying all the hidden archaeology beneath. Neat paving of stone or clay-tile was substituted, and massive slabs were laid down to cover the entrances to vaults. These slabs had to be lifted every time a family interment took place (Litten, 1991, ch. 8).

In the eighteenth century the alleys between blocks of box pews became progressively more restricted, as the ground beneath the

church filled to capacity. These alleys were coveted as burial places for yeomen, merchants and the emergent professional classes, so that gradually the paving was replaced by ledger stones. At the same time graves became deeper (1.5 to 2 m), to allow for the vertical stacking of coffins. Consequently, church floors were disrupted more seriously, and more often.

Some cathedrals and the parish churches in cities were subject to intense burial pressures in the seventeenth, eighteenth and early nineteenth centuries, so much so that their floors were almost always in a state of upheaval. The stench of corporeal decay became a notable urban feature. Stone and brick-lined grave shafts and vaulted chambers occupied every available space, and in so doing brought about the total or near-total destruction of all earlier floors. Westminster Abbey, London City churches, Bath Abbey and the eastern arm of Bristol Cathedral provide examples of saturation burial. With that came a near-total carpet of post-medieval ledger slabs. In some cases these have survived in situ, while elsewhere they have been partially or wholly cleared to make way for new paving schemes of Georgian or Victorian date.

Although a section of floor was destroyed every time an interment took place, crucial evidence was often concealed in the backfill of graves. Medieval tiles and their bedding mortars, lumps of concrete flooring, broken paving stones and fragments of older ledgers all turn up in grave fills and, although ex situ, these can tell us much about the floors that have been lost. Graves, especially when they are closely datable and stratigraphically related to floors, can be of great assistance in dating both the creation and the demise of those floors.

2.3 Ritual and secular activities and their impact on floors

The progressive compartmentation of church interiors in the Middle Ages, and the increasing architectural elaboration applied to certain areas, especially the sanctuary, led naturally to differing emphases being placed on particular parts of the floor. Indeed, many a church floor ceased to be a single entity, but became a series of discrete units, each with its own history. The most obvious division lay at the chancel arch, where a screen, and perhaps a step, physically divided the two main cells of a parish church, encouraging separate treatment of their respective floors. While in rural churches the nave often retained an essentially 'earth' floor down to the eighteenth century, the chancel was usually paved in the later Middle Ages. To some extent paving occurred incidentally as a result of burial: the desire to be interred in the sanctuary, and especially in front of the altar, led to a proliferation of floor slabs in most chancels. Alternatively, the chancel might be given a decorative tile pavement, although that would quickly have become fragmented as the pressure for burial here gained momentum.

The fashionable introduction of timber screens in the fourteenth, fifteenth and early sixteenth centuries – often associated with the creation of family chapels and chantries – led to the compartmentation of larger churches. Eastern chapels were usually screened off, both laterally from the chancel, and from the aisles; transepts were similarly separated from the body of the church, and may also have been subdivided into chapels. In most cases the division was achieved either by resting a timber screen directly on the surface of the existing floor, or by digging a shallow trench and embedding a sill-beam in it. The old floor might, for a while, remain unaltered on both sides of the screen. Thus at Barton-upon-Humber the Perpendicular chancel screen was placed on top of a fourteenth-century chequered tile pavement, which continued in service.

In many cases, however, the screened area was soon refloored as a discrete entity, to enhance the setting of the chapel. The new floor was often laid on top of the old, thus introducing a step at the point of entry. In

other cases, piecemeal reflooring came about as a result of burial. As the lower parts of timber screens became submerged by rising floor levels, they began to rot and were then either underbuilt in masonry, or were physically jacked up (as scars on piers and responds reveal). Either way, the process led to more emphatic divisions within floor structures.

Points of restricted access, such as doorways into churches and openings through screens, concentrated wear on floors and it is thus common to find renewed paving in those areas, or large stone slabs laid to one or both sides of the threshold. Thoroughfares, processional routes, and zones of intense activity (e.g. around an altar) likewise led to concentrated wear on floors. In the case of earth floors, a hollow-way could quickly be worn, necessitating frequent patching and periodic renewal of the entire surface. A fine example of this was found in the north transept at Hadstock, where an external doorway had existed prior to the fourteenth century (Rodwell, 1976). A north–south hollow had been worn across the centre of the transept through successive earth and chalk floors.

Wear patterns on solid floors made of soft stone, tile or brick can be equally striking, whether on the level or in the form of flights of steps. The wear on the limestone stair leading to the chapter house at Wells Cathedral is a dramatic and often cited example (although now partly renewed). Stairways to towers and rood lofts, and in particular their threshold stones, provide innumerable examples on a small scale. Areas of intense circulation, or repeated movement back and forth, produce distinctive wear patterns on floors. Amongst the commonest are the spaces in front of altars, around fonts and alongside shrines. A notable example of liturgical movement patterns was recorded at St Mary Tanner Street, Winchester, by contour-planning the worn earth floors during the excavation of the Anglo-Saxon church.

While defined routes concentrate wear on certain parts of floors, they also relieve the pressure on other areas. The introduction of screens and monuments assists with the latter: people do not generally walk close to walls, or circulate in tight corners, and these areas therefore enjoy a high degree of natural protection. Glazed medieval tiles in pristine condition often survive in the corners of chapels and vestries, under altars and behind tombs, whereas those in doorways may be worn down to half their original thickness.

From the fourteenth century onward there was a gradual increase in the quantity of wooden furniture in churches, notably stalls, benches and, later, pews. At first confined to the chancel, these soon spread into the nave. By the sixteenth century most parish churches were probably well-cluttered with furniture, much of which was fixed to the floor. Excavations sometimes reveal shallow slots in earth floors, into which the frames of benches were set. The presence of fixed seating naturally created alleys or 'aisles' within the nave: there was invariably an axial east–west route and at least one running laterally across the church, to connect the north and south doorways. In a complex church there would be another cross-route, west of the rood screen, linking the aisles, transepts or eastern chapels. Thus the floor of the church was effectively divided into rectilinear blocks which may be unrelated to the architecture. The alleys between the furniture were (and often still are) paved in a manner that differed from the blocks they defined. While the latter may have had earth floors, or rough stone flags, the alleys themselves were frequently provided with neat pavements of cut stone or ceramic tiles. Total excavation of the interior of the nave and aisles at Barton-upon-Humber revealed numerous remnants of the tile-paved alleys and the late medieval furnishing pattern that they defined.

In the large open spaces of cathedral naves, where there was little if any furniture until recent times, processional routes and 'stations' were sometimes permanently marked in the stone-paved floors. Such was the case at Wells, where in the 1780s John Carter

recorded a series of twenty-two stones which marked medieval processional positions in the western part of the nave. The evidence was later destroyed by reflooring (Paul, 1891).

The floors in a late medieval church could be extremely complex and fragmentary, having evolved over several centuries as fashions changed and burials, tomb structures, altars and seating arrangements proliferated. In the later sixteenth century many subsidiary altars, chantry chapels and other unfashionable features were stripped out of churches, leaving a pattern of diverse flooring that no longer made sense in relation to its surroundings. New patches of paving were introduced to make good the scars left by iconoclasm. The seventeenth century saw yet more destruction of church fittings, when numerous ancient tombs were swept away, or wrecked and removed later. Again, the impact on floors was considerable.

The Reformation not only destroyed rituals and the accoutrements associated with them, it also profoundly changed the internal geography of churches. Processional routes and circulation spaces in chantries and around altars and shrines ceased to be used, and sometimes the Holy Table was placed in the nave, stripping the chancel of all its former liturgical functions. The floors that had guided and reflected the diverse uses associated with the different parts of a church suddenly lost all meaning. New patterns were imposed on floors. The nave, aisles and even the chancel could be filled with box pews, the disposition of which created fresh circulation patterns. The construction of manorial pew enclosures, family chapels, and nave pulpits all changed the internal planning of churches. A new generation of massive tomb structures was also born, and many of these occupied the sites of former altars, including sometimes the high altar.

Increased interest in personal comfort meant that box pews were often provided with timber floors, laid down directly upon the remains of their medieval predecessors. Much decorative tiling and many fine grave covers were concealed from view, and unintentionally protected, by this means.

The mid-nineteenth century saw a return to medieval ideals in church planning, which involved the destruction of Jacobean and Georgian interiors, and with them went the complementary flooring arrangements. Three centuries of post-Reformation change and development could be undone in a single year. The thoroughness with which the Victorians pursued restoration and re-ordering involved massive destruction of the archaeological deposits which had accumulated over many centuries. Floors were reinstated at what was considered to be an appropriate medieval level. New tile pavements and stone alleys were laid on deep beds of rubble and concrete, and pews were installed on raised timber platforms. Sometimes these platforms were constructed directly on top of old floors (which were thus preserved), but more often a ventilated void was created to prevent timber decay. These sub-floor voids were usually 30–50 cm deep, and co-extensive with the pew platforms. Inevitably, the archaeology of the medieval floors in these areas was destroyed.

Victorian floor restorations were often steeped in conscious antiquarianism, and it may now be difficult to determine whether a particular arrangement, or feature, reflects authentic evidence that was observed and copied, or whether it was pure invention. Thus extant patches of medieval tile flooring may be genuinely in situ, relaid following the original design, a combination of both, or a fabrication using old tiles that came to hand. Many a church has a 'museum display' of medieval tiles that were found and reset in the floor during a restoration (Figure 2.1). Some nineteenth-century encaustic tile pavements were composed from pattern-book designs, while others were at least partially based on archaeological evidence, and incorporated specially made tiles replicating examples found on the site. Thus, when Scott repaved the choir at Lichfield in 1860 (see Plate 19) he used Minton facsimiles of many of the tile designs employed in the now-lost fourteenth-century pavements

Figure 2.1 Lichfield Cathedral. Scott's 'museum' of tiles on the floor of the Consistory Court, 1861. Various thirteenth- and fourteenth-century designs surround four pieces of cannel coal which had been used for black and white paving in the choir in the late seventeenth century (Photograph, Warwick Rodwell)

Figure 2.2 Lichfield Cathedral. Unusual brick substructure to support Scott's limestone paving of 1860 in the north choir aisle (Photograph, Warwick Rodwell)

there. The medieval layout could not be replicated, since that had been destroyed in the late seventeenth century when a chequered stone pavement was laid. The chapter house at Salisbury Cathedral had a complete thirteenth-century tile pavement until 1856, when it was torn up and replaced with a facsimile (see Plate 4). Again, new Minton tiles were made to the original designs (Spring, 1987, p. 155).

The recycling and rearrangement of components of historic floors occurred frequently, and can cause considerable problems in interpretation. Ledger slabs are often not in their original locations: sometimes they were moved around more-or-less at random during restorations, or they might have been shifted slightly during a 'tidying up' operation. Moreover, it is not unknown for a slab to be shunted, or trimmed, to make space for another burial to be inserted in a crowded floor. Medieval canopied tombs and later chest tombs were often removed, as obstructions, and their top slabs were sometimes let into the floor, with the result that a brass or inscription, although not strictly in situ, may nevertheless still mark the site of the interment to which it relates.

New steps and paving were frequently made from parts of older tombs in the eighteenth and nineteenth centuries, and it is the dimensions of the slabs that often betray their likely origin. A large stone was worth re-dressing to remove an unwanted inscription or the indent that formerly housed a brass. Tell-tale evidence of the latter is seen in the form of lead plugs and the stumps of brass rivets, which are now flush with the surface of the stone but which were once in the base of an indent; some good examples of re-dressed Purbeck marble matrix-slabs may be seen in Wells Cathedral (Rodwell, 1994). Ledger slabs were sometimes inverted, placing the inscription face-down, but this was not common practice because the undersides of these stone were generally too uneven. However, the side panels of dismembered chest tombs, especially those of easily dressable limestone, made useful paving slabs when laid face-down. Careful archaeological examination may reveal that a complex historic floor is replete with semi-disguised fragments of sepulchral monuments.

2.4 Assessing, recording and interpreting a floor

Most pre-Victorian church floors were palimpsests of archaeological evidence, representing an accumulation of artefacts over some six centuries. The different materials used, their disposition within the building, their relationship to architectural features, the extent of their survival, and the minutiae of wear patterns on their surfaces are all significant. Together, the floors of a church enshrined the building's history in microcosm, a history that could be read like the folios of a manuscript. Comprehensive repaving schemes were carried out by the Georgians in some of the more affluent churches, but in a majority of cases historic floor palimpsests survived well into the nineteenth century. Many of those floors were swept away or drastically 'improved' during Victorian restorations, but some have only been lost in modern times. Those floors that still remain, however depleted, are precious reservoirs of evidence relevant to a host of academic disciplines.

The first requirement for any study of a floor is an accurate plan, on which every stone and joint is shown. A scale of 1 : 20 (or larger) is essential to register the subtleties of a complex historic floor, although a tile pavement cannot be meaningfully recorded at a scale of less than 1 : 10. In cases where a floor has been wholly relaid in Victorian or modern times, using a consistent form of paving – perhaps with the occasional older ledger stone remaining – planning at a scale of 1 : 50 suffices.

In the past, records of stone floors have tended to be schematic with too much concentration on the major monuments in the mistaken belief that genealogy was the only serious concern. Tile pavements too have been poorly recorded, in this case in the belief that the general scheme and a corpus of the individual tile designs were the only things that mattered. All the subtleties of floor laying techniques, meaningful misalignments, wear, patching, etc., were missed by this superficial approach. To measure and draw accurately every element of a large tile pavement is an excessively time-consuming process, and in 1988 a new approach to floor recording was pioneered at Lichfield Cathedral. The Library pavement (see Plates 20 and 21) was recorded by rectified photography and a complete photo-mosaic prepared at a scale of 1 : 10. This was then reconciled with a measured plan of the building (Rodwell, 1989b). The pavements in the eastern arm of Winchester Cathedral have now been similarly recorded.

Once a complete plan has been prepared, separate copies should be coloured and annotated to record materials and surface indications on a stone by stone basis. One plan will record the geology of the stones. Another will detail general condition, including localized wear, fracturing, surface damage, discoloration and burning. Depending on the nature of the floor and the materials incorporated, other plans may be required to record details such as mortars and jointing, stone

dressing, scars and shadows left by the removal of superimposed structures (tombs, screens, stall bases, pulpit steps, etc.), and the positions of former fixings (dowel holes, lead plugs, iron stumps, and rust stains). Stones or tiles which have sunk indicate subsidence into underlying archaeological features, while those which stand proud of their surroundings have usually been lifted in order to conceal services, or to make good a former sinkage. The limits of disturbed or relaid patches of flooring – perhaps representing several intercutting phases of activity – may be defined by different mortar types. All such subtleties should be recorded and interpreted.

The floors of many cathedrals and some churches were planned by antiquaries in the eighteenth or nineteenth centuries, usually for the purpose of showing tomb locations. Such documents, even if imprecise by modern standards, can provide much valuable information on the archaeology of a floor. The same applies to Faculty papers and re-seating plans for parish churches. Antiquarian descriptions and perambulations, even when unillustrated, sometimes embody useful observations about floors. It is surprising how much can, with reference to extant floors, be interpolated from general views of interiors showing tombs, screens and railings that have long gone, steps that have been eradicated, pulpits and fonts that have been moved, and other residual scars prior to 'tidying' operations by Victorian restorers.

Numerous old sources of evidence can help to explain patterns of flooring, as can knowledge of relatively recent fixtures and services. Continuous lines of paving of consistent width often conceal former hot-air or pipe ducts. Patches of discoloration, fissuring or calcining on ancient floor surfaces point to the sites of braziers, or where roof timbers lay burning during a conflagration. Large slabs, often of Yorkstone, and not of tomb-sized proportions, may have been introduced to support tortoise stoves. Rust stains, lead-filled sockets and fragments of iron embedded in masonry joints point to lost tomb railings, pricket stands, screens and gates.

Tomb-sized ledger slabs usually covered the interments to which they relate, but the interpretation of smaller inscribed stones may require more careful consideration. Small plaques, especially those set in eighteenth-century chequered paving, are sometimes retrospective, being in situ replacements for ledgers that had been cleared away or, alternatively, they may simply commemorate interments that took place outside the building. A group of small stones relating to a single family may overlie a vault, and the configuration of the surrounding flooring is all-important in deciphering what lies underneath. A ledger slab edged by a series of narrow stone slips (15–20 cm wide) usually points to a brick or stone lined shaft; the slab itself rests on the walls, while the slips cover the backfill of the construction trench. Two identically sized ledgers of the same family, set side by side, usually betoken an underlying vault, squarish in plan and of two coffins' width. A plain uninscribed slab lying to one end of a major ledger may be the removable cover over the steps or ramp leading down to a family vault. Chips around the edges of such a stone, or on those immediately adjacent, provide additional evidence of periodic lifting and replacing.

Partly worn tile pavements were often taken up in antiquity and the best of the tiles recycled in a new floor (perhaps in a less important part of the church). Consequently, careful study of the surface wear and damage to individual tiles is necessary in order to determine if that could have occurred in the present location, or if it was a legacy of a previous use. Establishing whether tiles are in primary, or secondary, positions is fundamental to the correct dating of a floor. The mortar beds of lost pavements are often encountered in excavations. Although the tiles may have been stripped off, tell-tale imprints in the underlying mortar reveal the dimensions and general arrangement of the components. Invariably a few broken fragments of tile remain, while others may be recovered from the excavation of graves or service trenches that punctured the floor. Hence, through archaeology, it may be

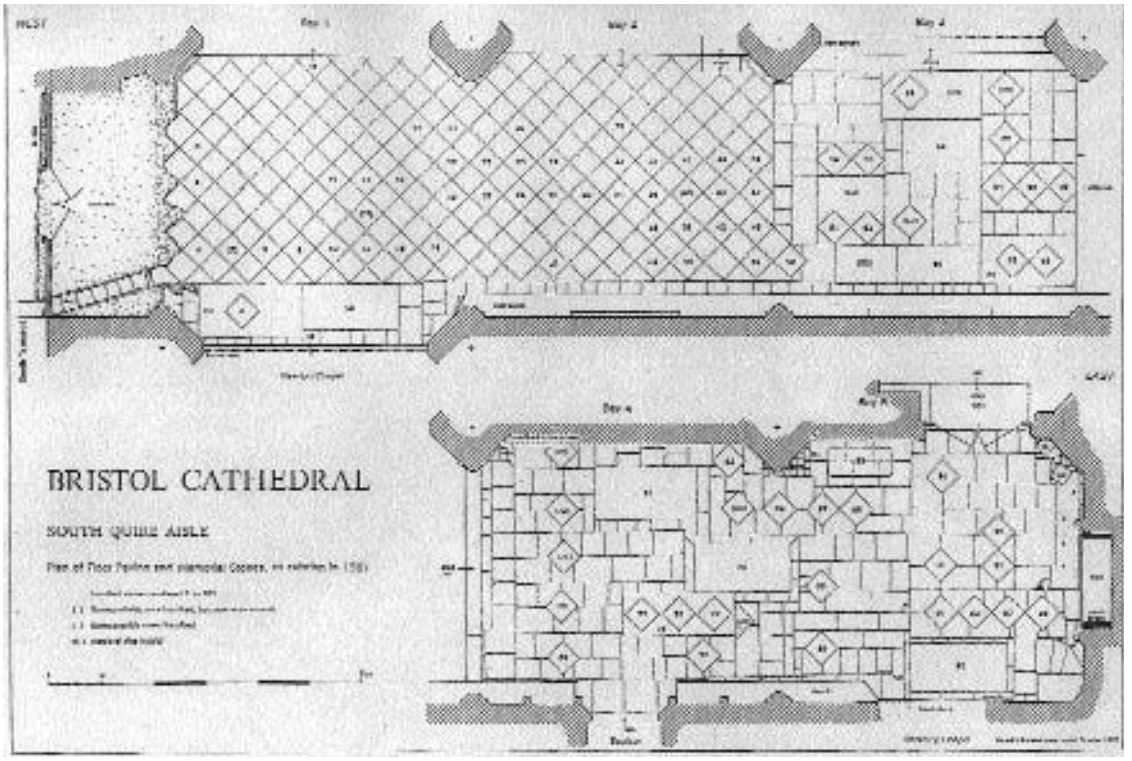

Figure 2.3 Bristol Cathedral. Basic floor survey of the south choir aisle. Eighteenth-century diagonal paving in bays 1 and 2; complex paving containing ledgers and memorials of sixteenth to nineteenth centuries in bays 3–5. The outlines of thirty-five probable vaults and grave-shafts can be detected in the floor patterning of these three bays

possible to determine the date, layout and elements of the design of a tile pavement that was destroyed several centuries ago.

It is clear from the foregoing examples that careful recording and analysis of flooring materials can reveal much evidence that has otherwise been lost concerning patterns of movement within a church, structures and monuments that have been swept away, and the distribution of burials. In the mid-1980s there was a proposal (mercifully aborted) to lay a new floor in the south choir aisle of Bristol Cathedral, the existing one being regarded as worn out and of no interest. A survey of the five bays of the floor (Figure 2.3) revealed 101 memorial stones, mostly with legible inscriptions (Rodwell, 1988). In bays 1 and 2 there were commemorative plaques only, these being embodied in an eighteenth-century diagonal paving scheme in black and white marbles. Bay 3 contained rectilinear stone groupings indicative of thirteen burial vaults beneath the floor. It also retained evidence of a former step across the aisle, which, together with the now-destroyed screen that stood upon it, is seen in a nineteenth-century engraving. Bays 4 and 5 comprised a complex grouping of paviours, ledgers and commemorative stones suggestive of a possible twenty-two vaults and grave shafts, some of which were intercutting (Figure 2.4). An area of fresh nineteenth-century stone paving in front of the entrance to the sacristy was explained by reference to an engraving of 1801, by Samuel Lysons, which showed that a patch of late medieval tiling had survived here. The importance of maintaining access to the sacristy evidently

Figure 2.4 Bristol Cathedral. View of South Choir aisle floor looking west, with bay 5 in the foreground (Photograph, Warwick Rodwell)

discouraged burial in front of its doorway and thus, more by default than intent, was responsible for the late survival of a portion of medieval pavement. A few specimen tiles were reset in a corner of the aisle, where they still remain.

The first stage in a detailed survey of all the floors and sepulchral monuments of Wells Cathedral, carried out in 1993–1994, revealed a very different but no less complex story (Rodwell, 1994). Here, the historic floors survive to a large extent in the eastern arm, whereas those in the nave were heavily depleted and reordered in the 1960s; at the same time the largely medieval flooring of the cloister was totally destroyed. The remaining small areas of medieval tile paving were recorded and analysed in detail (Rodwell, 2001, p. 449–81).

The recording and interpretation of historic floors has at last moved away from amateur antiquarianism, largely inspired by the pursuit of genealogy. Floors are palimpsests of historic evidence but, unlike documents, they are three-dimensional rather than two-dimensional. Excavations inside parish churches and cathedrals in recent years have revealed the complex structure of floors and how these can be meaningfully related to successive phases in the history of the building, shedding light on past ritual and sepulchral activity that was presumed lost beyond recall. Nevertheless, it is a tragedy that so much was swept away before the value of 'floor archaeology' came to be recognized.

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3

The two great marble pavements in the sanctuary and shrine areas of Canterbury Cathedral and Westminster Abbey

Tim Tatton-Brown

The two most important floors to survive from medieval England, are also perhaps the two most splendid pavements ever to have been made in the British Isles in the medieval period. These floors, as might be expected, are in the most sacred areas of two of the greatest medieval buildings in Britain, Canterbury Cathedral and Westminster Abbey. The Canterbury pavement area is immediately adjacent to the now-demolished shrine of St Thomas Becket in the Trinity Chapel. It was laid in c.1182–1184 and c.1213–1220, while the Westminster Abbey pavements, laid in 1267–1269, are around the shrine of St Edward the Confessor, and in the sanctuary immediately to the west. It has been my privilege to study both pavements (at Canterbury in 1979–1981 and 1997, and at Westminster in 1996–1997), and, though my research has not yet been completed, a brief summary of the history and archaeology of both floors will be attempted here.

3.1 The Trinity Chapel pavement in Canterbury Cathedral

The rebuilding of the eastern arm of Canterbury Cathedral after the devastating fire of 5 September 1174 is quite exceptionally well-documented by the monk, Gervase. His year-by-year account of the rebuilding was translated and studied by the brilliant scholar, Professor Robert Willis, as long ago as 1844. As a result of this, we know that in the seventh year after the fire (1181) the new eastern crypt was completed, 'and above the crypt the exterior walls of the aisles up to their marble capitals' were also completed before the winter rains put a stop to the work. In the following year 'The master erected eight interior pillars [in fact double pillars], and turned the arches and the vault with the windows in the circuit. He also raised the tower [i.e. the Corona] up to the bases of the highest windows under the vault' (Willis, 1845, pp.61–2). Thus it is that Gervase tells us that the interior of the Trinity Chapel, where the shrine of St Thomas Becket was to be placed, was effectively built and completed in 1182. This interior contains many magnificent Purbeck marble bases, column drums and even some wonderfully carved capitals, but incorporated into these are some column drums of a rose-pink marble, which until recently was not provenanced. This same pink marble is also used for six single bases (and some shaft-rings and capitals) in the outer aisle

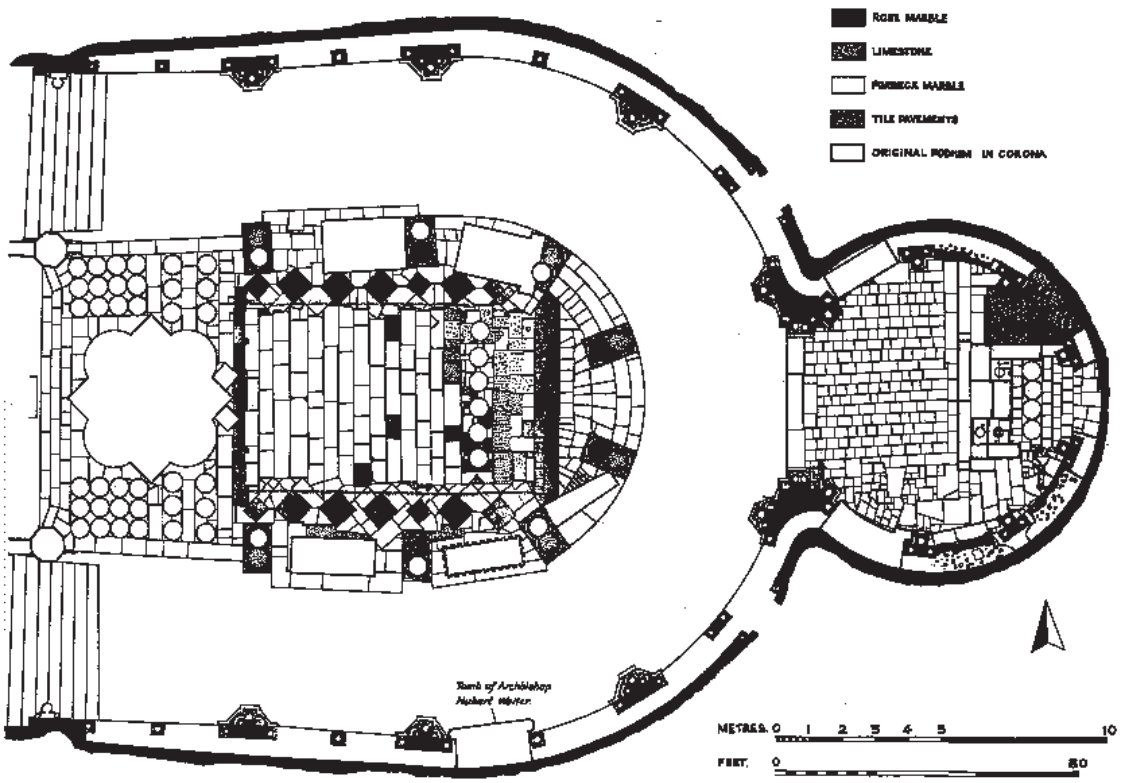

Figure 3.1 Canterbury Cathedral. Plan of the pavements in the Corona and Trinity Chapel (© Canterbury Archaeological Trust)

walls, as well as for the few surviving fragments of the shrine base itself (Tatton-Brown, 1981). More importantly for our purposes here, it is used in the paving of the floor immediately around the shrine of St Thomas Becket, both in a lozenge pattern on the north and south sides and as strips in the floor immediately to the east and west of the shrine podium (Figure 3.1). The use of this rose-pink marble, which almost certainly came from the Phillipeville area of modern southern Belgium,[1] is confined to the central area of the Trinity Chapel, and it was clearly a scarce material that was only used for the shrine itself, and for its immediate surroundings.[2] I do not know of any other medieval use of this pink marble in England, though it was imported for monuments in the post-medieval period.[3] It seems highly likely, therefore, that the paved area in the centre of the Trinity Chapel (including the shrine podium) was laid immediately after the chapel's completion in 1182–1184. The rest of this floor is made of Purbeck marble slabs with a few slabs of Large Paludina Limestone (i.e. Wealden, Bethersden or Sussex marble), and in the ambulatory and

[1] It was supposed to be a Sicilian marble and a gift from the Pope (e.g. Woodruff and Danks, 1912, p. 99), but Dr Freda Anderson has recently compared the pink marble to a sample she has brought back from Belgium, and the match is very close.

[2] In the two double columns of the apse to the east of the shrine, only the lower drums are of the pink marble; higher up Purbeck marble is used again, possibly suggesting that the pink marble had run out.

[3] For example, at Westminster Abbey, where a similar marble is used in a late seventeenth-century repair to the Great Pavement (see below).

Corona chapel floors (Horton and Norton, 1981) much of the original Purbeck and Wealden marble flooring also survives, all of it probably laid in 1182–1184.[4]

In an earlier article (Tatton-Brown, 1981) I have attempted to show that some time after the shrine of Thomas Becket was demolished in 1538, the three steps of the podium for the shrine were pulled out and laid flat in north–south rows in the centre of the floor (Figure 3.1). By studying the wear patterns on these stones, the original three steps of the podium can be reconstructed (on paper), as almost all of them are still there in the floor. Below the bottom step of the podium, and still on the in situ pavement, a hollow was worn by the countless pilgrims who visited the shrine in the 300 or so years that it was in being (see stippled line on Figure 3.1). This was the crucial evidence to show the exact size of the podium. Flanking the north and south sides of the shrine, and built *on* the pavement, are the famous tombs of the Black Prince (1376), and King Henry IV and Queen Joan of Navarre (c.1437). There is also Archbishop Courtenay's tomb (1396) to the southeast and Dean Nicholas Wooton's early Renaissance tomb (1567) to the northeast, as well as the strange bricked-up and plastered-over coffin of Odet de Coligny, Cardinal Chatillon (1571) beyond Archbishop Courtenay to the southeast. Thanks to the protection of these tombs, the areas on either side of the old shrine pavement have been quite well-preserved, though the east end of the pavement is now suffering quite a lot of wear from tourists.

Immediately to the west of the shrine of St Thomas was, and still is, the most spectacular area of floor, the so-called *opus Alexandrinum* pavement (Plate 11). This remarkable pavement was heavily restored in the later nineteenth century, probably in the 1870s[5] under G.G. Scott, but it has rather surprisingly never been studied in detail. The basic form of the pavement is worked out using circles and squares within squares set diagonally (i.e. *Ad Quadratum*).[6] Long thin strips (semicircular and straight) of Purbeck marble are then used for borders, and within this are set a whole series of different marble patterns using a mix of imported marbles, particularly purple porphyry, green porphyry (often called *Serpentino* or *marmo di Lacedæmoni* in Italy) and a grey-to-white marble. These materials must have come from central or southern Italy (particularly Rome), where new porphyry and marble inlay (*opus sectile*) floors in a late Roman tradition were being created from the late eleventh century onwards.[7] The marbles that were used were all taken from ruined Roman buildings, so that material like purple porphyry (originally from the eastern Egyptian desert) and green porphyry (originally from Sparta in Greece) would have come to Canterbury from Italy, no doubt accompanied by skilled marble workers (*marmorani Romani*). The name *opus Alexandrinum* comes from the name of the early third-century Roman Emperor, Severus Alexander (AD 222–235), who was said by his biographer, Aelius Lampridius, to have been the first to introduce marble work, using the two

[4] Sadly the original Purbeck marble choir aisle flooring (c.1176–1180) was mutilated in the 1870s when the radiator pipes were put in.

[5] Documentary evidence for this has not yet been found, but the outer parts of the *opus sectile* work are now within late Victorian gun-metal borders. I am grateful to Mrs Margaret Sparks and Miss Anne Oakley, who have searched the Canterbury Cathedral Archives for me.

[6] There is a brief note and drawing to show the geometry in Dudley (1969, p. 31).

[7] Probably the earliest example (sadly now destroyed) was the floor of the great Benedictine abbey church at Monte Cassino. The use of *opus sectile* pavements was a re-introduction from the eastern Roman Empire. As well as the purple and green porphyry and white marble, there are also small amounts of granite (almost certainly *granito del foro* from Mons Claudianus in Egypt) in the original mix. The very centre of the Canterbury pavement has a square green porphyry piece surrounded by three semicircles of granite. The fourth semicircle is of Genoise serpentine, a post-medieval repair.

materials already mentioned, purple and green porphyry.[8] This suggestion is, however, unlikely to be accurate, though the use of purple and green porphyry in Roman imperial work increased greatly during the third century AD.

The patterns in the pavement are clearly derived from the marble pavements being made in Italy in the twelfth century, though no direct parallel can be cited. The major element that is missing in the Canterbury pavement is the use of spiral designs (a sort of guilloche), which are found in all the classic 'Cosmati' pavements, including those at Westminster Abbey (see below). The construction and design of the Canterbury pavement still awaits detailed analysis, but it is clear that quite a lot of original work still survives in the centre of the pavement, while the surrounding outer segments are entirely nineteenth-century reconstructions, using different materials which were cut mechanically.[9] There is also an earlier repair, including the re-laying of large parts of the central pavement, which seems to have been carried out in the late seventeenth or early eighteenth century.[10] The repaired areas use 'touch' (a form of Tournai marble) and a pink Devonian limestone, both of which materials probably came from Belgium.

On the north and south side of the *opus Alexandrinum* pavement are two other, quite different pavements (see Plate 11). These are made up of thirty-six encrusted stone roundels (*dalles incrusteés* in French), which are set in four groups. These roundels were all very carefully studied in 1929 by N.E. Toke, when the pavement was undergoing its most recent restoration, and when a group of five roundels were returned to the pavement.[11] All the roundels, which are exactly two Roman feet in diameter, are made of a fine-grained white limestone (perhaps Caen stone), and into the top surface has been cut a series of pictorial and decorative scenes representing the twelve signs of the zodiac and twelve labours of the months, as well as seven (or eight) virtues and vices and a group of 'fantastic' monsters. The incised areas are filled with a reddish mastic, but many of the roundels are very worn. Adjoining the *opus Alexandrinum* pavement on the east side are two lozenge-shaped panels, but the southern of these lozenges contains a roundel, probably with a virtue and a vice.[12] The two groups of six roundels on the northeast and southeast sides of the *opus Alexandrinum* pavement are all set in Purbeck marble paving and are almost certainly in situ, and, as Toke showed, the roundels here are in pairs. Each has a labour on the east and a zodiac sign on the west, and, running from north to south, they must represent January, February, March and October, November, December. Unfortunately the groups of roundels on the northwest and southwest sides of the central pavement have been moved around on several occasions (most recently in 1929, as we have seen), and their original positions cannot be ascertained. Various early plans and engravings (starting with those of the mid-seventeenth century, engraved by Hollar) show the *opus Alexandrinum* pavement and the roundels in roughly their present form, but they are not accurate enough to help. However, a late

[8] *Alexandrinum opus marmoris de duobus marmoribus, hoc est porphyretico et lacedaemonio primus instituit.* For marble pavements in Italy, generally, see Hutton (1950).

[9] These materials, mechanically cut, are set much more closely, and have very smooth surfaces. All are in metal borders.

[10] William Gostling in his *A Walk in the City of Canterbury* (1777), says 'the curious and beautiful mosaic' was 'some years since repaired'. It is possible that Canon John Bargrave (1610–1680) was involved in this, as he had visited Italy in the Commonwealth period, and brought back various 'antiquarian stone samples' (Sturdy and Henig, n.d.).

[11] See Toke, 1930, pp. 189–221. The five roundels were in the Henry IV Chantry chapel and before this in the crypt. The chapter minute book of 1870 (DCc/CA13 p. 273) records an order 'to bring up from the crypt the similar stones [roundels] now lying there, and to place them in Henry IV's chapel?'.

[12] These lozenges are certainly in situ, as the wear pattern below the bottom step of the shrine podium runs across their east sides. See Toke (1930) and Eames (1982).

seventeenth- or early eighteenth-century relaying of this part of the pavement does seem to have taken place. Along the north side can be seen Cancer, Sobriety and Luxury, a purely decorative roundel (moved further eastwards in 1929) and Libra. Cancer, the crab, close to an octagonal pillar on the northwest, is the best preserved, and may be in situ.[13] Between the roundels, in the middle, are areas of marble-inlay decoration, but these do not use 'Roman' marbles and are probably late seventeenth- or eighteenth-century designs. Two triangular areas on the south side, and one on the north (shown in outline on Figure 3.2), do seem to contain their original medieval decorative scheme,[14] so it is likely that the arrangement here of a group of twelve tightly packed roundels is original. The southwest group of twelve roundels is more worn and disturbed, but the Gemini roundel at the southwest corner (also near an octagonal pillar) is the least worn, and may be in situ. The two roundels immediately to the north (May and Leo), and their surrounding marble inlay were restored to here in October 1929, as were the two roundels in the same position on the north side (Figure 3.2).[15]

Figure 3.2 Canterbury Cathedral. Roundels from the *Opus Alexandrinum* pavement. The drawing shows the amount of wear on the tile, and was made in c. 1858.

N.E. Toke has shown that the nearest parallels to the stone roundels are to be found in the St Omer area of northwest France, and he goes on to suggest, very plausibly, that the monks, on account of having spent their exile of 1207–1213 there, on their return in 1213, brought back with them the idea of having similar roundels in the Trinity Chapel. It is therefore likely that the roundels were laid here between 1213 and the translation in 1220. The *opus Alexandrinum* pavement, from its position, must have been laid before the roundels, but whether this took place in 1213–1220 or in 1182–1184 is not known. The earlier date is, however, perhaps more likely on stylistic grounds. One other small piece of evidence that may be relevant comes from the cathedral at Old Sarum. During the 1913 season of excavations there, several loose fragments of purple and green porphyry were found,[16] and at about the same time the floor of the three eastern chapels there were uncovered. In front of the altar step in the central chapel, the floor 'retained the mortar bed of a

[13] Being near a pillar, it would have been less walked on.

[14] The surface is now dish-shaped, and made of small triangles and squares in tile. Roughly similar small tiles of an early thirteenth-century date can be seen in the eastern arm of Rochester Cathedral.

[15] See Toke (1930). This figure is reproduced in Babington (1933, p.96). For the original drawing see H. Shaw, *Specimens of Tile Pavements* (London, 1858).

[16] See interim report in St John Hope (1914), 116. Seven fragments of green porphyry (one with a curved edge) and one of purple porphyry can still be seen in the Old Sarum collections at Salisbury and South Wiltshire Museum.

curious pavement of interlacing circles, but not of the same material as the altar platform, the stones comprising it having been flat and not rough underneath'.[17] Though the excavators did not realize it, this was almost certainly a more elaborate *opus Alexandrinum* type floor with purple and green porphyry in it that was laid in the late twelfth century, perhaps in conjunction with a proposed new shrine for Bishop Osmund.[18] Another place that has produced a large number of purple and green porphyry fragments is St Augustine's Abbey in Canterbury. Once again the records relating to their discovery are very poor (Sherlock and Woods, 1988, pp.135–7), but it is worth noting that the eastern arm of the Abbey was rebuilt after a fire in 1168, and a new shrine of St Augustine is said to have been dedicated in 1221.[19] A new marble pavement could have been laid at either of these dates, but with the destruction of the eastern crypt at the dissolution (and the digging out of the crypt in 1900–1901), all evidence for the position of the pavement will have been destroyed. There may also have been a decorated marble pavement in the thirteenth-century eastern arm (the New Work) of Old St Paul's in London. Here there seems to have been a 'parcel of pavement of black marble spotted with green similar to some at Westminster,' according to Harrison's *Description of England* (quoted in Lethaby, 1906, p.328). This pavement was apparently near the shrine of St Erkenwald.

3.2 The Sanctuary and Shrine pavements in Westminster Abbey

The eastern arm of Westminster Abbey was magnificently rebuilt between 1246 and 1259 by King Henry III, and once the main structure had been completed, new floors were laid (Colvin, 1963, pp.130–57). In the aisles these were of Purbeck marble,[20] but in the sanctuary, and the chapel of St Edward the Confessor, much more elaborate pavements were conceived from the beginning. In 1259 the newly elected abbot of Westminster, Richard Ware, went to Rome to seek confirmation of his appointment by the Pope. He had to go on to Anagni, the papal summer residence, and there he would have seen a magnificent series of recent Cosmati floors in the cathedral, and its splendid crypt.[21] On his return, Abbot Ware probably told Henry III of what he had seen, and on a second visit, in 1267–1268, Italian marble workers must have been commissioned to come to England to make not only the two new pavements, but also to decorate the new shrine-base of St Edward and Henry III's own tomb. Much of the uniquely splendid Cosmati work on each of these structures still survives, and, as far as is known, this work in Westminster Abbey is the only place where Cosmati work was used north of the Alps in the Middle Ages. The two pavements are quite different from each other, and since the mid-fifteenth century have been separated from each other by the great screen behind the high altar.[22]

The sanctuary pavement was until February 1998, almost completely covered up,[23] but a useful drawing of it was made by the Royal Commission on Historical Monuments in 1924 (Figure 3.4). This shows clearly that the pavement is made up of rows of rectangular slabs of Purbeck marble, into which has been cut a whole series of interlocking circular

[17] This is how it is described in the excavation notebook, quoted in RCHM (1980, p.18).
[18] For a plan of this pavement, see Clapham (1934, p. 160, fig.43). See also T. Tatton-Brown 'The Burial Places of St Osmund'. *Spire* (69th Annual Report of the Friends of Salisbury Cathedral, 1999) pp. 19–25.
[19] Thorne's Chronicle, Col. 1877. See Davis (1934, pp.189–91).
[20] Some of the original Purbeck marble paving survives in the ambulatory, but most has been cut out for later burials and ledger slabs.
[21] The main pavements in the cathedral were relaid in 1882. The crypt pavement is still in its original form, and it has recently been cleaned and conserved along with its magnificent wall-paintings, see Ravasi (1995).
[22] The high altar dais west of the screen may also have been covered in Cosmati work, but this was all destroyed after the Reformation.
[23] Only small sections in front of the Coronation Chair and around Bishop John Waltham's ledger stone and brass could be seen until the pavement was uncovered in February 1998.

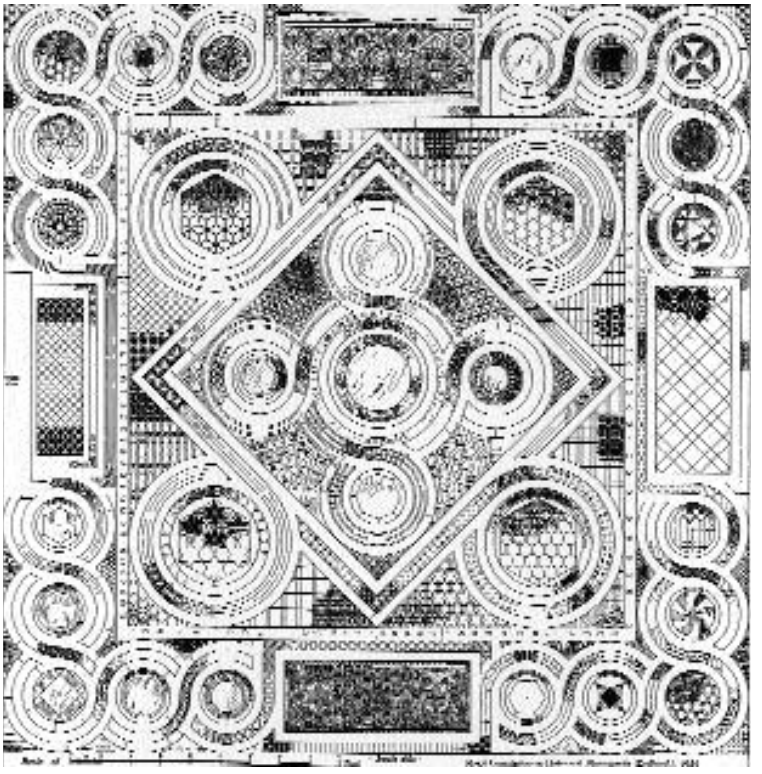

Figure 3.3 Westminster Abbey. Presbytery pavement plan, 1924 (Photograph, National Monuments Record)

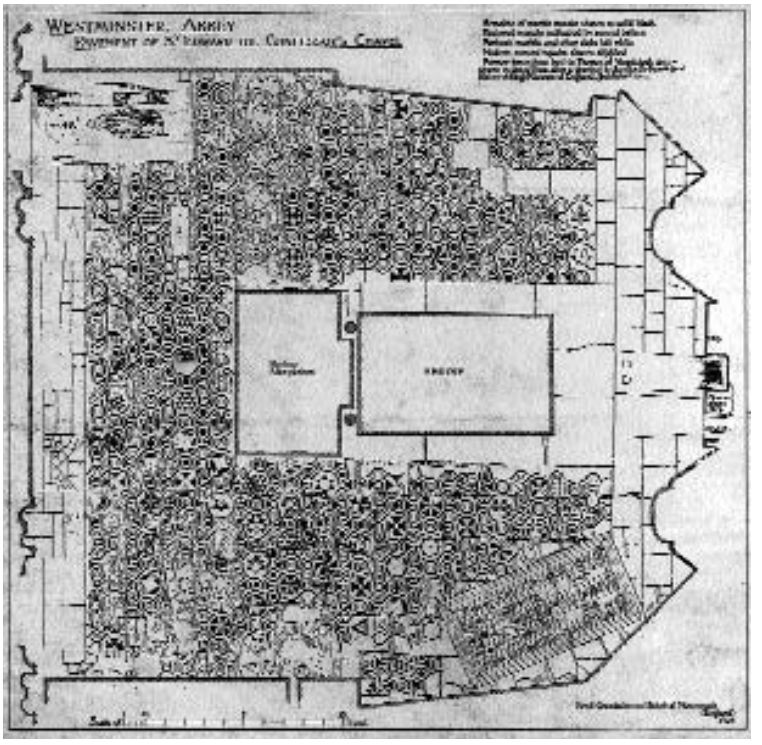

Figure 3.4 Westminster Abbey. Chapel of Edward the Confessor (Photograph, National Monuments Record)

designs (Figure 3.3). The design must have been marked out on the pavement once the slabs were in place, and within the cut grooves designs of purple and green porphyry and white marble were laid, as well as some coloured-glass inlays. In the centre of the pavement the podium for the shrine of St Edward was made at the same time, c.1268, while around the edge of the pavement the plinths to the later royal tombs of Henry III, Edward I, Edward III and Richard II overlap the pavement, as do the steps into the Henry V chantry on the east. Two large later tombs for Bishop John Waltham (1395) and Thomas of Woodstock (1397), on the northwest and southeast, respectively, were cut right through the pavement (Figure 3.4). To the east, however, the graves of John and Margaret de Valence were laid into the pavement in c. 1277, and the two grave-covers, though very worn, still contain, at the east end, brass letters and fillets, and red, white and gold inlaid mosaic work in a miniature Cosmati style.[24] This whole floor, and these graves, have not been seen (because of the covering) for about half a century, and only W.R. Lethaby has made any study of it.[25] The whole pavement has now been uncovered and will be cleaned and conserved. However, the general public have been excluded from the chapel of St Edward the Confessor.

The Great Pavement (Figure 3.3) in the sanctuary of Westminster Abbey was until early 1998 under a carpet which has now been removed permanently. The wonderful pavement beneath it will now be cleaned, conserved and consolidated, and then permanently displayed to the public, who will be able to observe it from the crossing area. This pavement has also been hidden under its carpet for many years,[26] and is in a very dirty state.[27] Remarkably, however, the pavement is still in fairly good condition having been restored on several occasions in the later seventeenth and early eighteenth centuries after damage was inflicted on it during preparation work for coronations. In 1706 Queen Anne's huge baroque altar-piece from Whitehall Palace was re-erected along the west side of the fifteenth-century high altar screen, and this very large structure most unfortunately overlapped and badly damaged the eastern three feet of the pavement. This altar-piece was removed in 1820, and the whole pavement was finally restored, and a completely new high altar dais (covered in marble work) was made by G.G. Scott in 1866–1869. Scott also had large holes dug (with Dean Stanley's active involvement) on either side of the pavement to uncover the buried pier-bases of Edward the Confessor's mid-eleventh-century sanctuary.[28] Scott then restored the pavement very skilfully with new purple and green porphyry (and other materials),[29] and this new work can be easily discerned today because (as at Canterbury Cathedral) all the new marble inlay is mechanically cut and has very sharp edges, and thin joints.

The history and 'hidden meaning' of the pavement has recently been authoritatively studied by Richard Foster (Foster, 1991), so only a brief résumé is needed here. A full colour photogrammetric survey of the whole pavement has also been made (see Plates 22a and 22b), and a provisional interpretation of this has been carried out to show which are original areas of the pavement and which are later repairs. While the cleaning work takes place, the survey will be used to record in detail every piece (there are over 30 000 pieces in total), and it is already possible to distinguish the different materials and patterns

[24] RCHM (1924, p.27). This has survived below the steps into Henry V's chantry.

[25] His brief conclusions are in Lethaby (1906). See also Lethaby (1925, pp.225–33 and T. Tatton-Brown, 'The pavement in the chapel of St Edward the Confessor, Westminster Abbey'. Journal of the British Archaeological Association **153** (2000)).

[26] But in 1989 a new 'tradition' was started of uncovering it for public display for a few days in February every year.

[27] It is particularly black because of a perished rubber underlay to the carpet.

[28] These pier-bases can still be inspected by lifting three gun-metal covers, made in 1867 to contain portions of a new Purbeck floor that had been cut away.

[29] The work was actually carried out by Henry Poole, the abbey's master-mason.

used in the secondary and tertiary repairs of the later seventeenth century. The original patterns are all set with purple and green porphyry, while the seventeenth-century repairs use alternative materials; pink Devonian 'marble' (for purple porphyry) and Genoise serpentine (for green porphyry) in the repairs of c.1660–1662, and 'touch', Lizard serpentine, and other quite different materials including Cipollino and Carrara marble and a black corallite limestone in the tertiary repair. The Scott repairs once again use purple and green porphyry but, as we have already seen, these were cut mechanically.[30]

The Great Pavement in Westminster Abbey is about 25 feet square (see Plate 10a), so compared with the large areas of Cosmati pavement in Anagni Cathedral or Roman churches such as S. Maria in Cosmedin, S. Clemente, or the great basilica of St John Lateran, it is quite small. However, the pavement itself is probably the most elaborate Cosmati pavement ever laid, and is unique in having a whole series of inscriptions in bronze (brass) letters set into the Purbeck marble strips of the pavement (sadly only eleven letters still survive in situ). These letters are also the earliest known examples of bronze lettering on any monument or pavement in Britain (Blair, 1987, p.136). Luckily all the inscriptions were documented in the fifteenth century, so it is possible to fully reconstruct them and their original positions (Foster, 1991, pp. 80–110). Around the edge the date, 1268, is given (it actually says 1272 less four years), as well as the three principal persons involved in it: Henry III, the abbot (Richard Ware), and Odoricus from 'the City' (i.e. Rome), who we are told 'put together these porphyry stones'. Around the circles of the central quincunx, the letters form elaborate mystical phrases (all are, of course, in Latin) which have never been fully understood. They reflect upon the length of the 'primum mobile' and the pattern of the 'macrocosmos,' and relate to scholarly ideas

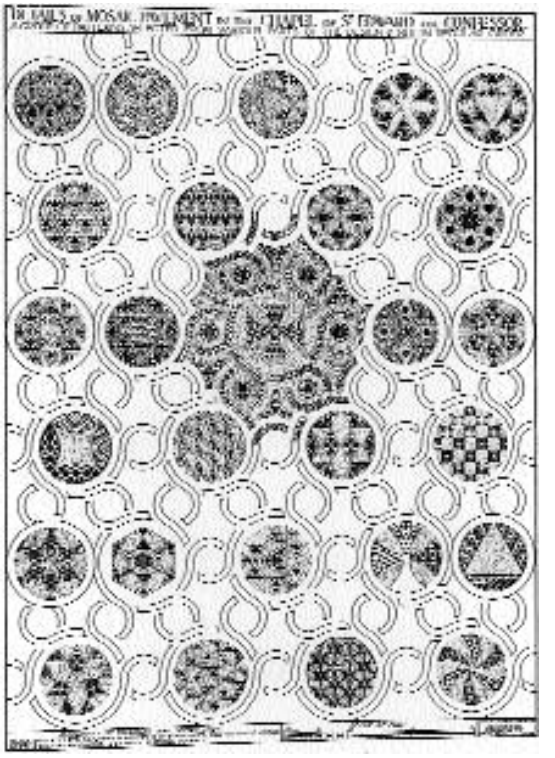

Figure 3.5 Westminster Abbey. Chapel of Edward the Confessor, details of designs (Photograph, National Monuments Record)

on the universe in the thirteenth century.[31] As well as this, the geometry and coloured stones of the central quincunx are exceptionally elaborate. At the very centre is a magnificent large roundel of Egyptian onyx marble surrounded by a border of red, blue and white glass petal-patterns (see Plate 10b).[32] Then each of the four roundels that surround it contain a stone of a different geometric shape: a circle on the east, a hexagon on the west, a heptagon on the north and an octagon on the south. Finally on the north and south sides of the pavement, two six-feet-long Purbeck marble grave-slabs (themselves covered in

[30] A steam engine was brought into the north transept of the abbey to cut the materials.

[31] Some of the wall paintings in the crypt of Anagni Cathedral have diagrammatic schemes of the four elements, the zodiac and the place of man in the 'micro cosmos,' see Ravasi (1995).

[32] The glass is probably Islamic in origin.

elaborate inlaid patterns of glass etc.) were incorporated into the original pavement, and these slabs were then lifted, and the space beneath used for the burial of Abbot Ware in 1283 (on the north), and his successor, Abbot Walter de Wenlock, in 1307.[33] Originally there were also bronze inscriptions around the edge of the grave-slabs, but they have sadly been robbed. However, both inscriptions were recorded in the fifteenth century, and they refer appropriately to Abbot Ware 'bringing these stones from the City [of Romel' and to Abbot Walter's burial under a 'marble cover'.

This wonderful pavement lies in the centre of the presbytery between the high altar on the east and the crossing on the west, and it is on the centre of this pavement that the chair of St Edward is placed for coronations. For all recent coronations, however, the pavement has been covered and completely hidden from view. It is very much hoped that for the next coronation (which will, no doubt, be seen all over the world on colour television), the Great Pavement will have been cleaned and consolidated, so that it too can play a visible part in the anointing ceremonies.

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[33] There is a Purbeck marble coffin below each grave slab, and these stone coffins were perhaps put in place in 1268, when the pavement was laid.

4

Archaeological research

Canterbury Cathedral Nave floor

Kevin Blockley

4.1 Introduction

Extensive excavations were undertaken in the nave and southwest transept of Canterbury Cathedral between 4 January and 20 June 1993, prior to an extensive programme of reflooring (1200 m^2), and the replacement of the old heating system (Blockley, 1993). Detailed study of the Portland stone floor (laid in 1787), covering an area of around 1100 m^2, revealed the layout of the late eighteenth- to twentieth-century liturgical fittings. After removal of the floor, over an area of around 600 m^2, detailed recording of the bedding mortar for the Norman floor revealed the layout of the medieval cathedral, and the changes that it underwent over a period of more than 700 years (Plate 23). Beneath the Norman cathedral were four phases of Anglo-Saxon cathedral, and although no floor survived in situ, finds from the excavations enable one to suggest some of the flooring materials used.

This case study gives an interpretation of the various floors and is organized sequentially by the main construction phases. A full report is now in print (Blockley *et al.*, 1997).

4.2 Anglo-Saxon cathedral

Four main phases of Anglo-Saxon cathedral were excavated beneath the Norman floor bedding mortar. The final Anglo-Saxon phase was destroyed by fire in 1067, but demolition work was not started until 1071.

No floors were located inside the Anglo-Saxon cathedral, although occasional finds recovered from the backfill of the 1787 grave-clearance pits provided information on the possible floors. Numerous fragments of *opus signinum* (mortar with crushed brick and tile added) were located. Some of these may have come from the underlying Romano-British buildings (one of which was located beneath the cathedral), but other pieces may have come from floors inside the Anglo-Saxon cathedral. An example of in situ Anglo-Saxon *opus signinum* was found lining the base and walls of a small Anglo-Saxon mausoleum, to the south of the Anglo-Saxon cathedral. Similar floors have been recorded in other Anglo-Saxon churches, for example the churches of St Peter & St Paul, at St Augustine's Abbey, Canterbury (Saunders, 1978, pp. 44–9), Reculver (Dowker, 1878), and Glastonbury (Radford, 1981, p. 117). A further important find was that of Late Anglo-Saxon relief-decorated floor tiles, two of which were located (one in a demolition layer of the Anglo-Saxon cathedral, the other in a 1787 clearance layer). The complete example, measuring 0.1 m^2, can be used to establish the design of the floor (Figure 4.1). Both tiles are heavily worn, suggesting they had been sited in prominent locations.

Figure 4.1 Late Anglo-Saxon relief-decorated floor tile, in a layer of Norman demolition rubble (Photograph, Canterbury Archaeological Trust)

4.3 Lanfranc's Norman cathedral

Archbishop Lanfranc's cathedral was built between 1071 and 1077, after demolition of the Anglo-Saxon cathedral. The floor was made of slabs of Marquise limestone, laid on a bed of mortar. The floor slabs were removed in 1787 when the burials were cleared from the nave and southwest transept and a Portland stone floor laid. Small fragments of the Norman floor were, however, located during the excavations, sealed beneath later medieval pier bases and walls. Many of the stones removed in 1787 had been used to backfill the clearance pits, the complete examples measuring up to 1.2 m by 0.8 m in plan and 0.2 m in thickness. Most were fairly well squared on the surface, but more irregular on the underside.

Detailed study of the bedding mortar showed not only the outlines of the individual floor slabs and their layout, but also the sequence in which they had been laid. Each slab had been set on its own patch of bedding mortar, frequently with small stones being placed under the slab to level it up. Detailed examination of these individual patches of mortar showed the relationship with its neighbours, and hence the sequence of construction. The floor had evidently been laid from east to west, starting along the tops of the arcade foundations, between the piers, and then in narrow rows across the nave and aisle

Figure 4.2 Norman floor-bedding mortar at the west end of the nave. Note the broken Norman floor slabs in the backfilled grave (removed during the 1787 reflooring), and the pattern of the 1787 floor slabs (scales 2 m) (Photograph, Canterbury Archaeological Trust)

spaces between the piers, followed by the infilling of the compartments with floor slabs laid along the axis of the cathedral. Surviving bedding mortar around the bases of the piers also showed clearly that the Norman pier bases were cruciform in plan (Figure 4.2).

4.4 Rebuilding of the nave

A complete rebuilding of the nave took place between 1377 and 1405 under the direction firstly of Archbishop Sudbury and later Prior Chillenden. This work involved the retention of Lanfranc's northwest tower, as well as substantial parts of the crossing and transepts (the northwest transept remained intact because of its association with Thomas Becket, whilst the

southwest transept was rebuilt soon after 1405). The southwest tower was rebuilt in 1424–1434. Although this work was a major undertaking, the original Norman floor was retained throughout, save in part of the Lady Chapel.

The Lady Chapel, inserted at a late stage in the rebuilding of the nave c.1405 (on the site of the Norman Lady Chapel) extended over three bays at the east end of the north aisle. Here the Norman floor was removed in the easternmost bay, and the ground level reduced by 0.35 m to provide for easier access from the cloister, via a doorway inserted through the north wall. It is unfortunate, once again, that this floor was robbed of its stone, although the bedding mortar, and one surviving stone indicated that the floor was a regular arrangement of Purbeck marble slabs measuring 0.3 m^2. Two steps must be postulated, providing access to the western part of the Lady Chapel. Around 1455 the Lady Chapel was moved to a new site on the east side of the northwest transept.

4.5 The Consistory Court

The Consistory Court lay at ground level below Lanfranc's surviving northwest tower, and is known to have been sited here from 1660. The original site is not known for certain. Only a relatively small part of its floor was recorded, because of considerable destruction by a later burial. Enough survived, however, to show that the floor of the Consistory Court was of plain ceramic tiles, 0.23 m^2, laid on a bed of clay. On the east side, the floor terminated at a straight edge, 0.7 m from the east wall of the tower, perhaps indicating the position of a bench. An adjacent tile, still in place beside the bench setting, indicated the location of a thoroughfare to a door in the east wall.

4.6 The burials

From c.1405, and until the reflooring in 1787, the Norman floor of Marquise stone was retained in the nave and southwest transept. Numerous graves, however, were inserted through the floor. Comparison between the excavated plan of the graves that had been cleared in 1787, and a reconstructed plan of the Norman floor slabs, shows clearly the methodology for siting the burials. Where a coffin was buried, only a single row of floor slabs along the axis of the cathedral was taken up, and the stones relaid after the grave had been backfilled. For larger burials, such as the medieval stone-lined graves, and brick-lined and vaulted graves, a section of the floor was removed (two rows of stones for the former, and three for the latter type of burial), and the floor relaid afterwards. Most of the burials were sited in relation to the bay divisions of the nave, perhaps partly for ease of insertion of burials in the pattern of the Norman floor, and also (particularly with regard to later brick-lined graves) because burial space may have been apportioned by bay.

Although it is thought that this regular insertion of graves related largely to the pattern of the Norman floor slabs, many of the burials would have had a ledger or indent laid over them. A plan of the nave floor was drawn by White shortly before the 1787 reflooring, recording eighty-seven burials. Of these fifty-two have a name recorded on the plan, and a further thirteen are identified by means of a key; the latter were largely medieval stones with indents for brasses. It is evident, therefore, that this plan does not record all of the burials, but out of twenty-seven brick-lined and vaulted graves, twelve can be identified on the plan, and a further seven of those on the key identified. The clearance of the burials in 1787 had been thorough and the ledgers and indents broken up and used as hard-core in the backfill of the graves. One of the stones with indents for brass was retrieved in the excavation, broken into four pieces (Figure 4.3). This can be identified with certainty by comparison with burial number 8 on White's plan as the burial of Sir William Lovelace (d.1577). This shows the accuracy of the 1787 plan, particularly since all of the brasses had

Figure 4.3 1787 backfill of cleared graves, showing ledger slab of Sir William Lovelace, and a complete Norman floor slab (foreground) (scale 2 m) (Photograph, Canterbury Archaeological Trust)

been removed in the 1640s (Hay, 1991, pp. 6–7). Most of the ledger stones were of Purbeck marble, with the occasional use of Kentish Ragstone. A small number of fragments of Marquise stone were also recovered with indents for brass. The latter represent stones from the original Norman floor reset over graves, but with the addition of memorial brasses having been set into them. Over 100 graves, twenty-seven brick-lined and vaulted graves, and three lead coffins were recorded during the 1993 excavations (Figure 4.4), predominantly clustering at the east end of the nave and in the southwest transept.

4.7 The 1787 reflooring

During the early months of 1787 the Norman floor and the various ledger stones were removed, many of the ledgers being relaid in the Chapter House (but since dispersed), others being broken up. The burials were then exhumed, save the brick-lined and vaulted graves which were left intact, and the graves backfilled with layers of stone and soil. Following this the nave was floored with Portland stone and the southwest transept floored with the more recent (Tournai marble) ledger slabs that had been retained from the nave. The Portland stones were evidently dressed on site, to judge from the large quantities of chippings located during excavation. The new floor was laid at an angle to the alignment of the nave. The Portland stones in the central space of the nave were rhomboidal, laid on the diagonal 13° off the axis of the cathedral; those in the aisles were a combination of rhomboid- and parallelogram-shaped flags, 12.5° off the axis. Narrow linear slabs were laid down either side of the nave. At the east end of the nave the Altar of the Holy Cross was moved, and the platform extended a further 2 m to the west. This area was refloored with Portland stones set 13.5° off the axis of the cathedral. The extended platform was not given a new altar until 1898 (this was recorded in Chapter Minutes). The southwest transept was paved with ledger stones laid along the axis of the cathedral. None of these were in their original position, since they had largely been moved from the nave, so they could not be matched with the burials and brick-lined and vaulted graves below.

4.8 Recent features

Detailed recording of the 1787 floor was undertaken on a 1 : 100 scale plan of the floor slabs. As each of the stones was lifted the following details were recorded: wear on the surface, thickness of the stone, type of bedding mortar, any masons'/tally marks (cut or painted), other surface features. Colour-coded plans were prepared showing the degree of wear, which stones were broken, and the different types of bedding mortar. This

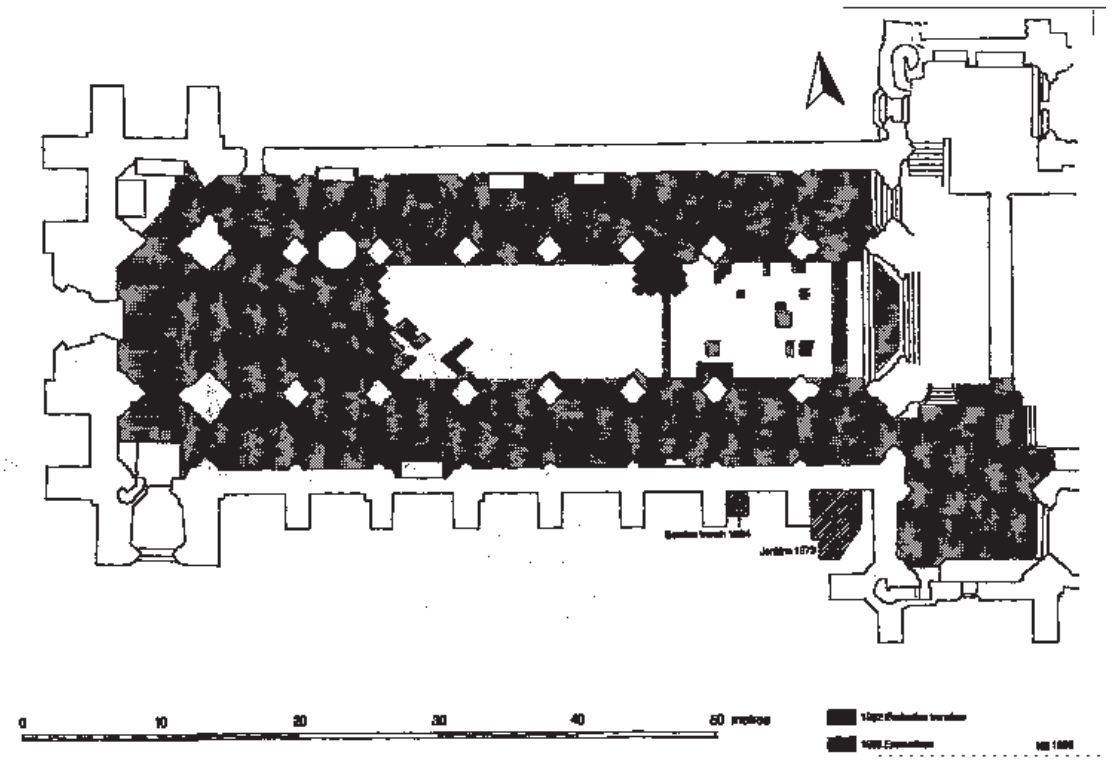

Figure 4.4 1993 location plan of excavations (Plan, Canterbury Archaeological Trust)

proved invaluable when interpreting the various alterations and additions to the nave from 1787. Some of the main features noted are outlined briefly below.

Insertion of services to the nave comprised the lifting of the narrow stone strips along the sides of the nave, or cutting of trenches for larger features. The gas lighting system, for example, installed in 1861, was inserted largely below the narrow strip of floor slabs along either side of the nave, at the foot of the piers. These were then relaid, on a new bed of mortar. Similarly, where the north and south gas pipes converged and joined together to pass along a specially constructed duct cut through the west wall of the nave, the floor slabs had been lifted and relaid.

The first heating system was put in in 1870, and comprised cast iron pipes, set in trenches cut through the floor of the aisles and across the east and west ends of the nave. These fed large cast iron radiators situated at various points around the cathedral. Insertion of this system involved cutting through the floor slabs. Although a number of these underground pipes had been removed it was possible by studying the mortar bedding below the floor to establish which of the floor slabs had been relaid in 1870.

Wear patterns on steps were also recorded during the course of the excavations. At the east end of the nave, the lower of the pulpitum steps (of Portland stone) was seen to have considerable wear in two places, at either end of the step close to the piers. This was thought, before excavation, to have marked the location of two doorways in the rood screen built in 1405 (Dart, 1726, p. 27, for a drawing of the screen; Tatton-Brown, 1990, p. 27). Further investigation revealed that the fifteenth-century steps in the nave were all of Purbeck marble. Further, there were fragments

of brick below the step, and the inscribed date of 1821 on the riser of the worn step, indicating that the pulpitum steps were replaced at that date. The wear pattern noted on the steps must therefore post-date 1821, and may perhaps best be interpreted as wear generated by traffic on either side of the Altar of the Holy Cross. Chapter Minutes record that the altar, removed from the platform in 1787 during reflooring work, was not replaced until 1898. This narrows down the time that wear could have taken place to post-1898. A further complication of two holes in the step, cutting the wear patterns, are probably related to iron rods that were placed beside an extended altar in more recent times. These rods are visible in numerous photographs of the Altar of the Holy Cross (e.g. Lang-Sims, 1979, p. 33).

Although the pulpit is now situated on the north side of the nave, on the second pier west of the crossing, this is not its original site. Recording the wear marks and dowel holes cutting into the 1787 floor, one may see five clusters of small holes, two of which are surrounded by dark octagonal stains (on patches of unworn floor), adjacent to the third northern pier. These are identical to the plan of the pulpit, as it now stands, but indicate that in this earlier siting the pulpit faced down the nave rather than, as today, into the nave. This location is recorded in Chapter Minutes as the original site of the pulpit in 1895. Chapter Minutes also record that the pulpit was moved in 1927 to the south side of the nave, against the second pier, but no evidence of this was located during the recording of the floor. It was placed in its present spot in 1935.

Replacement of the heating system in 1947 was extensive, and the system saw the addition of 'expansion loops' to allow for the expansion and contraction of the new copper pipes. The insertion of this system also left traces in the bedding mortar where disturbed floor slabs were relaid. More recent disturbance to the floor, which also resulted in the relaying of further floor slabs, was due to the insertion of electrical ducts, mainly along the side aisles, adjacent to the piers. Two phases of electricity supply can be seen; an earlier one employing iron duct pipes, and a very recent one with plastic ducts. All of these post-1787 disturbances were traced in the plan of the floor after the recording of different bedding mortars. Extensive wear of the floor, resulting from an increase in visitor numbers, and breakage of many of the slabs, was also recorded. The latter is thought to have been the result of large lorries in the nave in 1939 when soil was brought into the nave as a measure against possible bomb damage.

4.9 Conclusions

The brief outline above, regarding the layout of Canterbury Cathedral's Norman floor, the alterations undertaken during the 1377–1405 rebuilding of the nave, and the post-1787 fixtures and alterations, was only possible following very detailed recording of the excavated remains. The 1787 floor was recorded at a scale of 1 : 100, and all other surfaces, such as the bedding mortars, recorded at a scale of 1 : 20. Only after such detailed recording could the liturgical arrangement of the cathedral be mapped and followed over a period of more than 900 years.

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5

Ledger stones

Documentary sources: York Minster

If we need to restore a ledger slab or other memorial, presumably it is not now in its original condition. Whether or not it is desirable, practical or economic to restore it to its original form, we nevertheless need to know what that was. Therefore, our first stage is to find out what the memorial was like at as early a date as possible, before decay or damage occurred or was as serious as it is now. Our second stage, the present, is to record, by drawings, rubbings and photographs as appropriate, the present condition of the memorial before any restoration work is begun. The third stage, which lies in the future when the task of restoration is undertaken, consists of the similar recording of the memorial when restoration is complete.

The word 'ledger' means something that lies down or is laid down. The term is familiar as a large tome which because of its weight and constant use spends its active life lying on a Dickensian clerk's sloping desk. In my own world as a librarian and a historian of the book, the word ledger, more often in its alternative form 'coucher', means any large volume which in the Middle Ages, or afterwards, regularly lay on a reading desk or a table top or a shelf or a ledge. In this sense, a ledger or coucher book was most commonly a large service book for use on an altar or lectern, or a cartulary recording the documents – charters – on which an institution, religious or secular, based its property, rights and privileges. Similarly, in terms of memorials to the dead, a ledger slab is one lying down, whether on the interior floor of a church, or on an external floor such as a cloister walk, or even recumbent in a churchyard. It is thus strictly distinct from a wall monument inside or outside a building, or a vertical headstone in a churchyard. There is, however, no natural distinction between a horizontal and a vertically erected memorial inscription, whether in stone or in brass, except that the ledger slab is more liable to be regularly abraded by the repeated action of human feet and by floor cleaning, and consequently more liable to be in need of restoration.

Most of my examples will be taken from York Minster. There are now relatively few ledger stones and brasses on the floor of the Minster. In the Middle Ages and early modern times, however, there were several hundred of them. They disappeared, most of them, in two main stages. Henry VIII's minister, Thomas Cromwell, was mainly responsible for the destruction of the monasteries. In non-monastic churches such as the Minster he wrought less damage, but it was in his time as Chief Minister of the Crown that all the Minster's many chantries were dissolved. For the second stage of their disappearance we move on a hundred years to Oliver Cromwell and the destruction wrought by his supporters in the 1640s. After the Civil War and even before the execution of King Charles I, the episcopal

Church of England of which he was the head was abolished in favour of a presbyterian church, and York Minster in common with all cathedrals was governed no longer by an archbishop or a dean and chapter, all of whom were abolished, but was run as one of only four churches in the city served by preaching ministers.

Oliver Cromwell's party did cause some damage to one large category of funerary memorials in the Minster, most of them mounted in the floor but a few erected vertically on the walls. These were not straightforward ledger stones in the main sense; they were stones similar in general character but brought to a higher degree of costliness and showiness by the use of brass. The great majority were not the overall slab-sized sheets of brass that one usually thinks of in the context of brass-rubbing – and of course brass conservation – but smaller plates of brass recording the names and qualities of the deceased and sometimes their coats of arms. In many cases there were several small pieces of brass of this kind let into a single stone slab. Two such wall memorials survive, long stripped of their brass panels so that only the empty stone 'indents' remain. But these are exceptional in position and in style as well as in the fact of their survival. The great number of floor-mounted brass-ornamented slabs of this general type were stripped of their brass by the puritans during the Commonwealth period, and the metal sold on their behalf by one Richard Dossy. Both the stone ledger slabs proper and the others thus stripped of their brass insets vanished altogether eighty years later. They were removed and destroyed by a combination of the then Dean and Chapter and fashionable and famous architects and designers as part of a programme of general tidying up and beautification after the damage caused by the two Cromwells, Thomas and Oliver. This was part of the same general scheme in the 1720s under which the high altar was moved a bay eastwards to fill the untidy space left by the removal of St William's shrine and to make the choir look less squat and more elegantly longer.

The major element of the restoration of the 1720s was the beautification of the floor. While the purely stone inscriptions which covered so much of the floor were no doubt still in generally reasonable condition, legible in so far as anyone other than antiquarians could then read their mainly black-letter and Latin texts, the many which were indents empty of their brass were meaningless without their inscription plates and heraldry. They were also uncomfortable and even dangerous to walk over. So all were torn up and thrown out, and a new level and artistic pavement was laid, to the design of William Kent and the Earl of Burlington[1]. Even though there were then no chairs filling the nave, one still wonders how much of the grand design will have been apparent to a visitor standing at the end of the nave or an aisle. Nevertheless, on paper it certainly looked good, and up to date in the current architectural and artistic fashion, and it was comfortable and safe to walk on. It is idle to speculate whether nowadays a Fabric Advisory Committee and a Cathedrals Fabric Commission for England would allow a Dean and Chapter to do anything of the sort, but the fact remains that it was done. It is, therefore, now the Kent–Burlington pavement, much of it in fact replaced after the fires of 1829 and 1840, not to mention the restoration of 1967–72 and further restoration since then, that is here to be preserved, and not the medieval and early post-reformation floor slabs, with or without brass inserts.

Before leaving the Kent–Burlington pavement it is interesting to look a little more closely at the details of the design. Basically it is of course a simple Greek key-pattern, repeated over and over from natural starting

[1] For Burlington see Wittkower in Singleton (1954) and Barnard and Clark (1995) (neither mentioning the York Minster pavement), Wilson (1984) and Wilton-Ely (1985) (the last not mentioning the York Minster pavement).

points to natural finishing points, with the need for ingenuity and care at meeting points at corners, and a more original variation centrally under the crossing. In all probability Kent and Burlington never worried about the details, and all this was left to the masons. In the case of the Kent–Burlington pavement, we are unusually fortunate in possessing among the Minster archives the original masons' contract, complete with its accompanying plan still present. But let us compare it with contemporary engravings showing the actual pavement as newly laid. In the early 1960s, before the most recent restoration, the plan and engravings and the actual floor were compared and it was found that no two were alike. This is a reminder of two important facts: first, that it is often craftsmen and not architects who before the nineteenth century were responsible for details of design; and secondly and more importantly, that if we possess one piece of evidence such as a pre-construction plan or post-construction drawing or engraving, whatever the artefact, we must not automatically believe that every detail is being correctly shown to us. Multiplicity of evidence does not mean uniformity or consistency of evidence. An unsettling thought for the greater number of instances where we have but one piece of evidence.

Neither the two Cromwells nor Kent–Burlington bring us to the end of the destruction of ledger slabs and similar memorials in the Minster. The new pavement of the 1720s covered the whole of the nave and the transepts, the centre of the choir and the choir aisles as far east as a pair of gates immediately east of the doors from the aisles into the choir. The Lady Chapel and the eastern extremities of the choir aisles were not relaid: this area seems to have remained an untidy dump, largely unvisited by clergy and public. Here alone remained a number of medieval and post-medieval monuments and ledger stones, and here future burials were to be allowed without fear of damaging the beautiful new pavement. For these another agent of destruction was required, and one came in the form of the religious maniac Jonathan Martin, who on 1 February 1829 set fire to the entire eastern arm of the Minster. Apart from damage caused by the intense heat of the flames, which melted the surface of large areas of limestone masonry, falling roof timbers smashed whatever they fell on, and the stone altar screen collapsed partly or entirely downwards to the east and smashed a row of medieval ledger slabs immediately to its east. Funerary monuments are of course legally the property of the descendants of those who erect them, and the restoration of those damaged or destroyed in the fire was no part of the restoration plan of the Dean and Chapter or the contributors to the restoration fund.

In 1831 the choir aisles were dug up for archaeological excavation 'to examine further the remains of the old crypt' (Hornby f.131). This explains why the Burlington pavement in these aisles, no doubt damaged in the fire, has disappeared. A year later in 1832 it was recorded that 'In the aisles of the choir the monuments are all in ruins: nothing is restored but the interior of the choir' (Hornby f.239). Two years later in 1834 progress is reported to the effect that 'the work of restoring the monuments is going on' (Hornby f.239). This restoration was largely or exclusively at the expense of such descendants as chose to repair, restore or replace the memorials of their ancestors. Relatively few did so. The nave fire of 1840 stimulated more descendants to restore memorials in the eastern arm of the Minster, now restored to glory, but others remain lost. Surviving fragments of two memorials long thought lost have recently been discovered in various storage areas and identified by the Minster's excellent inventory officer, Charles McCarter, and some form of repair and re-erection is a possibility for the future. In 1910 Dean Purey-Cust arranged a scheme for restoration work on fifteen memorials in the choir, but this was all relatively minor work, painting letters and polishing slabs. In the 1950s Dean Milner-White arranged for some repainting of a few

further monuments. In connection with the restoration of the structure of the east end and the liturgical re-ordering of the Lady Chapel in the late 1960s and the 1970s, and as part of restoration training schemes, a few additional monuments in the Lady Chapel and the choir aisles have been restored or repainted in recent years, mostly funded by descendants or grant aid as opportunity has offered. The present scheme is part of this ongoing process of attempting to rescue what needs rescuing, and of seizing opportunities of further restoration as they become available.

This survey of the main events, negative and positive, that have brought York Minster's ledger stones and other funerary memorials to the state in which they are today is introductory to the main theme of what we should do with them now. Before embarking on any restoration we need to be aware of this background of damage and destruction and occasional repair and restoration. While the incidents given relate specifically to York Minster, a parallel but not identical series of destruction and restoration will have taken place at all cathedrals, and needs to be investigated and taken into account before any fresh restoration is undertaken.

In respect of one of the York ledger stones it is important to recognize that what we are proposing to restore is not the original slab of 1667 but a post-1829 replacement, presumably provided by descendants about 1840. This is the memorial to Anne Prince, and it forms an excellent example of how necessary it is to research the history of any memorial or other artefact before attempting any restoration work. How far, if at all, this affects the treatment that this ledger should receive is an interesting supplementary question that deserves further consideration.

The York Minster register of burials, in its printed form, records: 'Anne, wife of Philip Prince, gent., died 1 March 1667, and was buried in the south aisle of the choir.' James Torr, writing in 1691, on his plan locates the burial more precisely on the floor at the foot of the sixteenth-century wall monument to Archbishop Matthew Hutton, and in his text (p. 250) gives this description:

'By the wall side lyes a new spotted marble' – remember that his fair copy is dated only 24 years after the burial, and his original notes were probably taken a decade or two earlier – 'at the head whereof is engraven this lozenge escocheon – sable an inescocheon inter an orle of 8 owles or – and underneath this epitaph'. He then reproduces in full the text of a Latin inscription extending to 47 words, and mentioning the proximity to Archbishop Hutton, described as her ancestor. In 1870 another local antiquary (Robert Skaife) wrote that 'The escocheon and epitaph seen by Torre [sic] have disappeared – no doubt as a result of the 1829 fire – and in their place I find the following restoration of the old inscription' – and he quotes an abbreviated Latin text, containing only fifteen words instead of 47, and omitting the reference to its proximity by blood and location to Archbishop Hutton. It is this abbreviated replacement text of the 1830s or 1840s that we are now preparing to restore.

Anne Prince is far from the only example of an inscription shortened on restoration. Lettering, of course, costs so much per letter, and statements that seemed desirable to grieving relatives or admiring friends immediately after a loved one's death may seem superfluous to later generations. An example from relatively modern times is the memorial to William Wilberforce, remembered as champion of the slaves. He died in 1833 at London, and was buried, not at Stoke Newington where he had asked to be reunited with his sister and elder daughters, but in Westminster Abbey, as befitted his reputation. While memorials to him were erected not only in the Abbey but also in his native city of Hull, in his county town of York he was long commemorated only by the Yorkshire School for the Blind founded in his honour, and no memorial was put up in the cathedral at the time. It was only on the occasion of the centenary of his death in 1933 that his admirers remedied this. Books which give any quantity of detail about the

vast number of memorial inscriptions in the Minster were all published before this date, and later books are all too selective in their coverage to mention this. There is no information about this inscription in any of the biographies of Wilberforce, or even in the Dean and Chapter archives. Only the local newspapers record its erection and, in one case only, the full text of the inscription. But why should we need to hunt like this for a twentieth-century inscription? Because it has vanished. It was carved not on a separate memorial tablet but directly on to the wall of the nave. Little more than twenty years ago, this section of wall was removed for a totally unrelated purpose, by an outside contractor, and owing to a lack of forethought and communication the Wilberforce inscription was simply chiselled out and thrown away. Its total disappearance became evident only when it did not reappear at the end of the operation. Ironically it was not long after this that Wilberforce was included among the worthy persons other than saints commemorated in the Alternative Service Book of 1980. The Dean and Chapter, when the problem was pointed out to them, were quick to provide a replacement inscription on a slate tablet, which was erected in or shortly after 1983, the 150th anniversary year of his death, fifty years after the original unveiling. The result may be seen in the nave, close to the earlier position. Fashions in style and length of inscriptions, however, had changed between 1933 and 1983 and the 48 words of the original have been replaced by nineteen words. The carving and erection of the new tablet produced from the Works Department the working drawings for the earlier inscription, not previously known to have survived. An important commemoration to one of Yorkshire's greatest men in worldwide reputation thus came close to being totally lost and forgotten. This example shows why careful attention to the documentary aspect of ledger stones and other memorials and artefacts is of vital importance.

As previously mentioned, before restoration we must investigate the evidence from the past of what the memorial was like when it was in good condition. As we would not be thinking about restoration if it were not now damaged or destroyed, the earlier the evidence the better.

Some of the earliest memorial inscriptions to be erected in the Minster were to the archbishops of the Saxon and Norman periods. These were in the position of honour at the east end of the cathedral, successively in the Saxon and Norman choirs that preceded the present choir. They disappeared long before the fire of 1829, but if evidence for their texts were required for restoration it would be found in the medieval series of lives of the archbishops of York, and the more detailed biographies of the first four Norman archbishops composed in the 1130s by Hugh the Chantor. The latter text survives in a fourteenth-century manuscript in the Minster Library, along with other copies in the British Library, as does the chronicle of the archbishops. One example is the inscription thus recorded from the tomb of Archbishop Thomas I who died in the year 1100. At least his contemporary biographer quotes this as his epitaph, without saying whether it was actually erected or a purely literary epitaph. Other briefer inscriptions, consisting of not much more than names, more certainly did exist on some of these tombs. These monuments disappeared too long ago for any wish to restore them to be likely or practical, but they are the earliest available category of evidence.

A second form of evidence which is sometimes helpful is heraldic visitations. These are records of tours of inspection conducted by heralds from the College of Arms from the fifteenth century until late in the seventeenth century. In the main they recorded pedigrees and coats of arms from documentary evidence supplied by the county families who wished their arms and their right to bear them to be officially recorded in this way. On occasions, however, the heralds would note incidental evidence of a related kind as they went around on their tours of inspection, and sometimes they thus recorded inscriptions and

coats of arms on memorials or in windows of York Minster and other cathedrals and churches. As an example it is convenient to use descriptions not of the Minster but of the church of Brandesburton in East Yorkshire. The herald William Flower in his visitation of 1563–4 notes an inscription which he describes as 'graven on a tomb'; actually it was on a brass tablet inlaid in the stone. As in the Minster, the brass inset subsequently disappeared (though part of it remains), but, unlike at the Minster, the stone remains.

In 1620 the antiquary Roger Dodsworth visited the same church of Brandesburton and made a fuller description. This makes it clear the Flower's first text was engraved on the now partly missing brass, and goes on to record three more inscriptions on stone. When Dodsworth made his transcription the opening seven words and two subsequent words had become illegible, but fortunately they had been clear for Flower to transcribe the text in full 56 years earlier. Thus each of the two descriptions includes some words or features not present in the other. Again we see the importance of not relying on one piece of evidence by itself but assembling as many descriptions as possible.

Most of the earlier visitations give only a little evidence of this sort, but some later ones are more detailed. An outstanding example is Dugdale's visitation of Yorkshire conducted in 1641, which gives the earliest detailed transcription and description of some of the ledger slabs and other memorials in York Minster. In the case of the inscriptions on stone they were in a similar state when next recorded fifty years later, but for the brasses on the floor this is in some instances our only evidence before the brass was removed and melted down as scrap metal a few years later in the Commonwealth period. The herald's manuscript remains in the library of the College of Arms in London, where it has not been available for general use, though in recent years the RCHM have been able to make limited use of it for their research on York Minster. Fortunately there is an alternative and more readily accessible source for the texts destroyed in the Commonwealth, in the form of transcripts by the antiquary Roger Dodsworth made in 1618–19. This manuscript survives in the Bodleian Library, and was long ago used by Drake, who made its texts and descriptions readily available from 1736. Drake, like Dodsworth, gives the inscriptions in their original Latin form, but some of the later less highly regarded editions of his book add to the text of the more important inscriptions English translations, which, though neither accurate nor elegant, are useful for those researchers whose Latin is less than comfortable.

From the heralds who repeatedly surveyed the whole country over a period of several centuries, we come to the individual antiquaries who more systematically described what they saw in a particular city or county. Their work began in the seventeenth century, and has never completely ceased. As far as York Minster is concerned a few monuments were recorded by Matthew Hutton, a local man who spent most of his later years as a clergyman in Northamptonshire and exchanging information with antiquarian friends in Oxford and London. It was in 1659, when he was a young man, that he noted down the texts and heraldry of a number of monuments in the Minster and some other churches of York and on his travels further afield. His main York Minster notebook is in the Minster Library, and another copy of this together with further manuscripts of his can be found in the British Library.

More important is James Torr, whom his contemporaries describe as a 'painful' antiquary. 'Painstaking' sounds more impressive to modern ears. A large part of his research was conducted by going through all the archiepiscopal and capitular archives that existed in the 1660s and 1670s. His achievement in analysing their contents has never been equalled, and is paralleled only by his own descriptions of all the monumental inscriptions in the Minster and the parish churches of York, and many other major

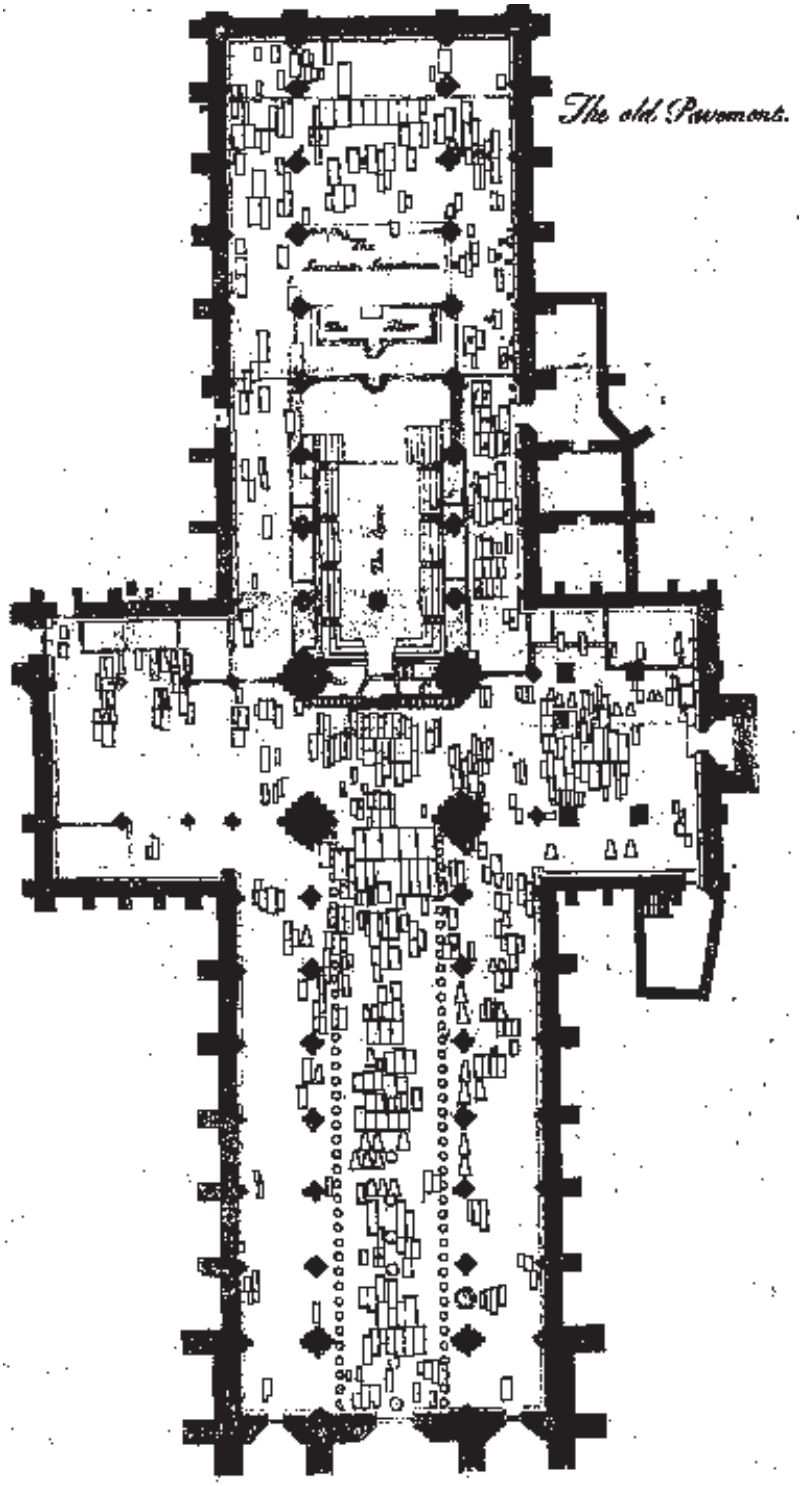

Figure 5.1 'The old pavement' from *Eboracum: or the history and antiquities of the city of York* (Drake, 1736)

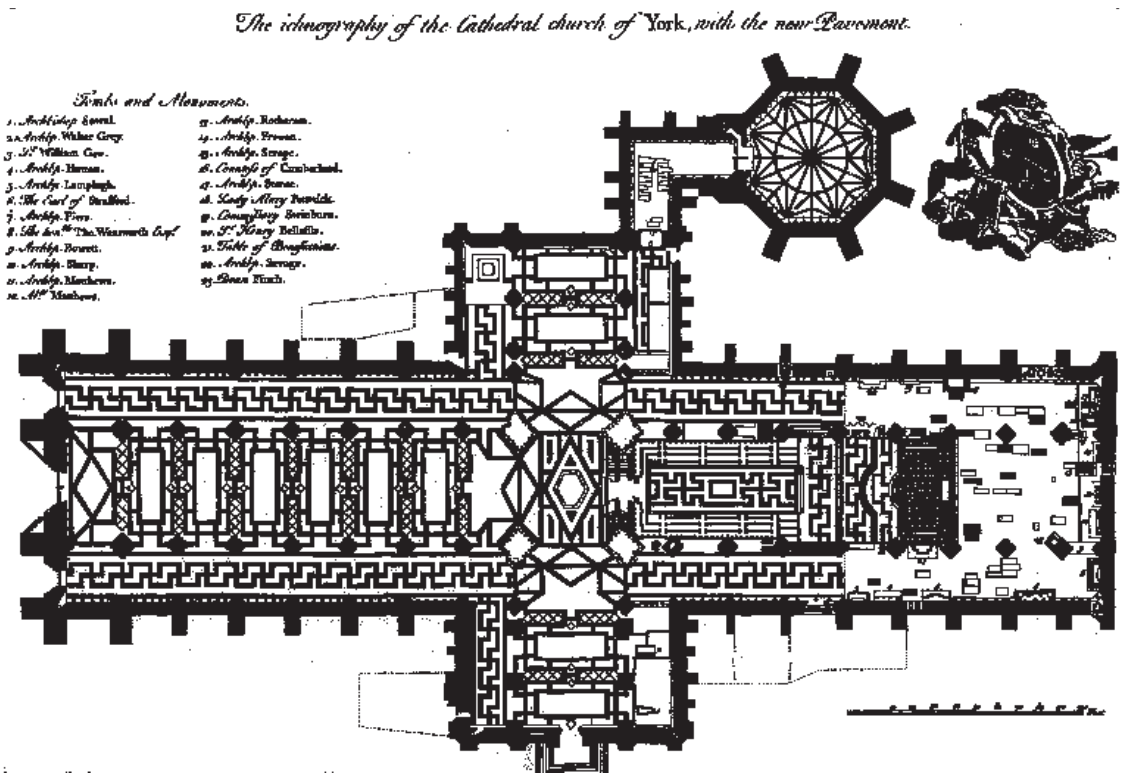

Figure 5.2 'The ichnography of the cathedral church of York, with the new pavement' (Drake, 1736)

churches in the diocese. For the Minster his fair copy volume, written in 1691 and in constant use in the Minster Library, is the primary source for everything up to his own time, excepting only the inscriptions and shields on brass destroyed in 1649. For these we have to have recourse to the heraldic visitation of 1641, Dodsworth's notes of 1618–19 and Drake's not always accurate printing of them in 1736.

Torr in 1691 marks the end of the seventeenth century and the end of the great period of manuscript evidence. From the beginning of the eighteenth century we come to mainly printed sources. The first dates from 1727 and applies not only to York but to thirteen other English and Welsh cathedrals. The author was Browne Willis, who in 1727–30 published his *Survey of the Cathedrals* in three volumes, reissued with a redated title page in 1742. With his wide coverage of so many cathedrals he could not print all the inscriptions, but his selection is far from negligible. While the quality as well as the quantity of his information varies from cathedral to cathedral according to his sources, in some cases fellow antiquaries who made transcripts especially for him, he is important in that for many cathedrals as for York his is the earliest printed and widely available account of many ledger stones and other inscriptions. From this date on there is a confusing wealth of similar information in print. For York the year 1730 saw the publication of a history of the city written by an eccentric printer called Thomas Gent. His book is very much a popular rather than a learned account, and we can rely on him to be inaccurate in almost everything. However, he should not be forgotten or ignored, and we must remember that in his *History of Ripon* published

in 1733 he included an extensive appendix intended as a supplement to his earlier York volume, containing descriptions of a number of Minster monuments, with woodcuts which are the earliest and the crudest available. Better known and more highly regarded is Francis Drake. His monumental history of York was published in 1736 and included the inscriptions recorded in 1618 by Dodsworth before the destruction wrought on the brasses by the puritans of the Commonwealth period (Figure 5.2). Unfortunately, either his amanuenses or his printers or he himself were deficient in their accuracy and reliability in details such as the spelling of names and the digits of dates, but the inexactitudes of his book do not equal those of Gent's. Various of the later editions of Drake's text, some complete and some in part, add English translations of the Latin, and new inscriptions for the half century following his original publication.

There are many later printed books about the Minster, but only three are of regular use for this subject. These are John Browne's of 1847, which gives detailed accounts of the most important medieval monuments, and adds information about later damage and reconstruction; Dean Purey-Cust's book of 1907, which is the first to include information about many of the eighteenth- and especially the nineteenth-century memorials; and Professor Gerald Aylmer's chapter in the 1977 *History of York Minster* giving useful details but not full inscriptions of the most important post-medieval monuments.

There are two more nineteenth-century sources of different kinds. The first dates from 1870, and is a printed version of the Minster's burial registers. While they do not begin until 1634 – the date varies from cathedral to cathedral – from that time on they are invaluable. In York's case we are fortunate that the editor, R.H. Skaife, adds to the bare text of the register a plan showing the exact position of each burial and memorial, and extensive notes not only identifying most of the persons named but giving the full text of every inscription. All are accompanied by invaluable additional information on such restoration as had been made and on removals of memorials from one place to another, a feature which has figured remarkably often in York Minster.

The final source of information dates from the 1880s but is primarily a manuscript document. It is a scrapbook compiled by a clergyman named Hornby. In addition to texts and a few actual photographs he includes relevant extracts from books and from newspapers, and engravings or woodcuts or tracings made from them. 'The Hornby Scrapbook', as it is known, is particularly good on damage and restoration in and after the two great fires of 1829 and 1840.

These are the principal sources which must be checked as a necessary first stage when preparing for the possible conservation of any ledger slabs or other memorials in York Minster. The same is true for any similar conservation projects at other cathedrals. Some of the sources – herald's visitations, Browne Willis's survey published in 1727 – are common to most cathedrals, all will have some manuscript and printed accounts peculiar to themselves, available either locally or in places such as the British Library, or more generally.

The next stage is to record the present state of a memorial before any work is begun, using photography, drawings, rubbings, as appropriate.

The final stage is to record both what is proposed to be done and what is actually done, in both cases with a description and an illustrative record. Changes of plan that become necessary as work proceeds must be recorded, together with their reason, and records should not be kept in the architects' office, which is at best only a temporary place of record. Very few cathedral architects in the past have transferred their records of work done back to their cathedral when they cease to work on it. Not keeping proper records of such work is bad enough. Keeping the information in the first place and then not ensuring that it is preserved and available for the future is equally reprehensible. One hopes that in future the necessity for architects to work

in close collaboration with Fabric Advisory Committees and the Cathedrals Fabric Commission for England will ensure that proper documentary research is undertaken and a full illustrative and descriptive record made and safely preserved for future consultation in the cathedral library or archive office.

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6

York Minster ledger stones

Conservation options

Charles Brown

The Dean and Chapter, after an appeal for funds from the public, gave orders that the vast ancient floor of the whole nave, the transepts, the crossing and the choir was to be taken up. The ancient floor originally of stone slabs was now a hotch potch of ledger stones, some with carved inscriptions, some with the indents of long-vanished brasses. The stones were all worn and uneven. The Dean and Chapter resolved to sweep all the old paving away and lay a floor of new paving in a striking black and white pattern inspired by the paving pattern of Ancient Rome. Some ancient stones were retained but turned over and a new sawn face presented. The bold scheme was executed.

This history is not of today, however. It is difficult to imagine such a radical scheme receiving approval in our time. The floors described were laid in York Minster in 1731 to a design by William Kent under the patronage of Lord Burlington, the notable Palladian and a landowner of Yorkshire. Only one area of the Minster remained in use for burials and that was east of the High Altar. In that area interments continued until 1836 and consequently the floor now contains many ledgers. Many of these, if they had not been damaged in the great fire of 1829 which destroyed the timber vault above, are now subject to abrasion from the feet of the 2 million visitors a year who walk around the Minster. It became markedly difficult to read the inscriptions and in 1989 it was resolved to take action.

Inevitably, physical intervention of some sort would be necessary if valuable stones were not to be destroyed in time by the feet of those who had come to inspect them! In some instances it was possible to install rope barriers and so redirect the 'traffic' or to adjust the position of furniture or soften its points of contact with the floor. However, many slabs remain on traffic paths.

The first course of action was to make a full record of the stones. There had been previous surveys by Torr, in the later seventeenth century, by Drake in the early eighteenth century and by Skaife in 1890. The importance and value of documentary sources is described in the previous chapter. These records, invaluable for they describe some stones long since vanished, were incomplete, however. The interest of those earlier recorders had been primarily in the words of the inscription and any heraldry. The size, exact position, material or style were not recorded. It was considered now that any record must be as complete as possible.

Considerable discussion was necessary to discover those features which had to be described before any new record was attempted. A pro forma was evolved (Figure 6.1). One form was to be completed for each ledger and a key grid plan was to show the location of each stone. The number of ledger

SCHEDULE OF FLOOR LEDGER STONES

Church: York Minster

Location of Ledger: St Stephan's Chapel **Plan No:** SS51. M12 .N12

Name (as on ledger) Lyonellus Ingram **Date:**

Inscription (literal):

HIC DORMI-
E VIGILATURU
LYONELLUS INGRA-
SI Q – LI FURR–
— RI- LECTO-
PRO IMUS TE
DOCEBIT PARI
OBIIT) OCTOBE
1628

Roman capitals
(size of letters and figures varies 1½ - 2")

ANO D-MIN-
1628

(Different type of lettering in last 2 lines)

Description:

(a) **Size:** 37 x 15½" 940 x 394 mm
(b) **Materials:** Stone
(c) **Heraldry:** None
(d) **Imagery:** None

Assessment:

(a) **Historic:** Possibly the oldest stone in St Stephen's Chapel
(b) **Aesthetic:**
(c) **Associational:** There is a wall monument to the Ingram family on the North wall. North Choir Aisle.

Condition: Surface and edges worn, and parts of lettering obliterated. There is a diagonal crack from the middle of the top edge to the right side.

Dates of Inspection: (1) 21.1.92 (2) (3) (4)

Methods of Record:

(a) **Rubbing:** *
(b) **Photograph:**
(c) **Cross References:** DUGDALE; JOHNSTON Ms top York c14 fo.40r; TORR p.266; WILLIS p.3; GENT p.120; DRAKE p516; DRAKE 1788 PP352, 353; SKAIFE

(d) **Other Information:**

Location of Record: York Minster Library
Grade: II

Figure 6.1 Pro forma for the record of ledger stones at York Minster. Survey carried out by NADFAS volunteers, 1992

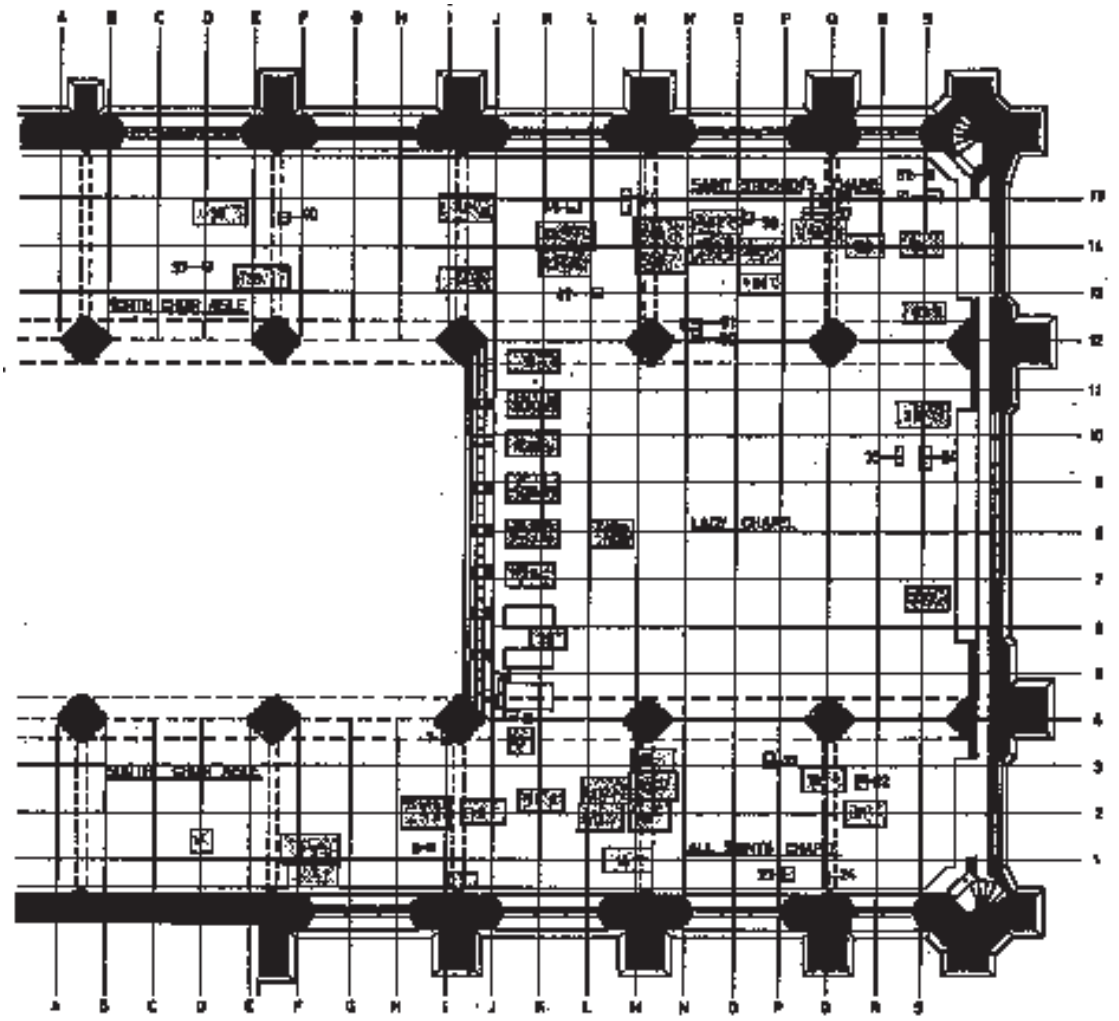

Figure 6.2 Floor plan indicating position of ledger stones, prepared by Charles Brown. An essential tool in the preparation of floor records

stones in York Minster, because of the history already described, is comparatively few. There are only sixty-four. Nevertheless to produce the complete record required much work. At York most of the labour was supplied voluntarily, efficiently and enthusiastically by a local branch of NADFAS.

Not only did the pro forma need to be completed but further recording is essential, namely photography and rubbings. The technique of photography is described elsewhere in this volume – in this case the photographs were taken by the Royal Commission on Historical Monuments for England (see Plates 24 and 25). The rubbings are achieved in exactly the same manner as brass rubbings, but great care has to be taken with deeply cut large letters or similarly cut heraldic devices. Loose dust and grit must be lightly brushed away before the rubbing with black wax is taken. If this is not done, the act of rubbing with trapped grit present could abrade the ledger stone or any inserted brass. Lastly the paper used should be acid free and

so ensure that the rubbing will be preserved for some time. Even the sixty-four ledgers of York form a considerable bulk of rolled paper (now safely deposited with the Minster Archives) and provision of adequate storage must be considered.

Many of the features of the pro forma are self explanatory but amplification of a few matters may be helpful.

1. *Location*. It is necessary, in addition to a straightforward description of location, e.g. south aisle, to produce an accurate plan of the area of inscribed stones and then to place a grid upon it (Figure 6.2). By this means an exact location can be recorded and depicted. The scale of such a plan must be recorded clearly and the grid adopted should relate to the form of the building. On occasions, in a building where there are changes of level, a three-dimensional grid may be necessary.

2. *Inscription*. A detailed record must be made at the inspection showing the exact spelling, spacing, punctuation and spaces if a portion is missing or effaced. The record should also show how the inscription is arranged in lines and whether letters are upper or lower case.

The rubbing of the stone will provide indication of the type of letter but it may not show how the letter is formed. It may be incised or raised. If incised, a description should be made of the form of the cut, e.g. is it a 'V' in section, or rounded, or a rectangular cut where the depth of the cut should be measured? If raised, is the lettering square cut, rounded or some other profile? The types of lettering are legion and many examples show intriguing variation from the standard due to the individuality of the carver. However, it is possible to give some description. For example does the lettering have serifs or not? Is it italic or upright? Is the lettering of a roman form or copperplate? If the inscription is in Latin or any other tongue, a translation should be shown alongside.

Heraldic carving is often found on ledger stones and very careful note should be made. The rubbing will provide a depiction of the heraldic device but note should be made of whether it is raised or incised. Some detail may be very worn and a further example of the same heraldry may be found on a nearby wall memorial. Despite the existence of the rubbing, it is important that a further depiction is made, however sketchily. The sketch should be shaded with the accepted markings for colour or metal, and moreover even rubbing and sketching should be supplemented further by a written description in the accepted terminology which can be found in most books on heraldry. If a motto is depicted this must be recorded also.

It is possible that a stone may have a non-heraldic device, or some other form of carved decoration, e.g. a geometric border. If so, a careful description must be made.

3. *Size*. The size of a ledger is shown with both imperial and metric measurements. This is desirable to enable comparisons to be made with any earlier records which may have imperial dimensions.

4. *Materials*. It is important to identify the material from which a ledger stone is made. This may not be an easy matter. Dust and grease impregnated into the surface of the stone may make identification very difficult. Nevertheless identification is not only necessary for the completeness of the record but also knowledge of the nature of the material could well influence the choice of the type of replacement stone if this is the option to be chosen in due course.

Many stones have inserted brasses, of all periods, although some brasses are now to be found remounted on walls to ensure their preservation. It should be noted if the fixings of the brass are secure and whether the stone around the brass is now so worn that the brass is proud of the floor. Such a condition could lead very rapidly to damage to the brass.

5. *Assessment: Historic, aesthetic and associational*. This information may not be known to the recorder and research is often necessary by others. There should also be reference to any mural monument or other memorial to which the ledger stone relates. This may or may not be nearby.

6. *Grade*. It became evident at York that it would be helpful to institute a system of grading. Such grading would be similar to that used when buildings are listed. Thus some guidance is given on the significance of the stone.

Grade I stones would be considered of great importance for sundry reasons. They may be historically important, commemorating a person of known significance or of note in the history of the building, for instance a founder of the church. They may be aesthetically important, by a known artist or of a significant and noteworthy design. Furthermore they may be of importance because of the material from which they are made, type of stone or other material. Grade I stones should be replaced, removed or copied only after the most painstaking consideration. The presupposition must be that they are not disturbed, but preserved.

Grade II stones are also of significance but preservation might be achieved by repositioning or copying. Grade III stones are those of least significance where, after recording, it is accepted that the inscription or design will in due course disappear through traffic wear, but they are not to be destroyed or moved. Ungraded stones must not escape the recording process but need not be preserved.

7. *Condition*. In this section, apart from remarks on present physical condition, there should be recorded any knowledge of any relocation of the stone during its existence. (It must be realized that relocation has sometimes occurred already to secure preservation or to accommodate a new floor design.) Also must be included an assessment of risk, i.e. the danger of further deterioration of the ledger for whatever reason. Risk may not only be from traffic wear. It could be from, for instance, rising damp from the ground below or from an unsuitable applied finish or polish.

The inescapable task of preparing an adequate record completed, the courses of action to preserve the ledger stones from further damage can be considered. The options, some already mentioned, can be summarized as follows:

(a) Remove foot traffic by creating barriers around the stone.
(b) Reposition the stone in an area where foot traffic is less.
(c) Remove stone to a museum.
(d) Recut inscription on existing stone.
(e) Replace stone altogether with a replica.
(f) Renew stone but with a new design.
(g) Cover the stone with a protective finish.
(h) Leave stone in position and accept that the inscription will disappear in due course.

Option (a) is of course the easiest option but sometimes difficult to achieve. The aesthetic effect of many rope barriers may not be acceptable and moreover the life of the church or cathedral, and such life includes visitors, cannot be impaired by making it impossible to move around the building.

Option (b) can be adopted especially if it has been discovered that the stone is already not in its original position. Such changes in location have often occurred in repaving in the eighteenth, nineteenth and twentieth centuries. However, the option should be adopted only after very careful study of the information gained in the survey.

Even more care must be taken before option (c) is adopted. It cannot be forgotten that the object of the stone is to mark a place of interment and the adoption of such a course is extreme indeed. However, if this is the only way of preservation, the option must be taken. If the stone is removed and it is known that it does lie over the place of interment, some small new plaque or inscription or even carved number should mark the burial.

To recut the stone (option (d)) is a proposal which can prove controversial. Obviously the original inscription is destroyed and the recut letters may not be able to replicate the original craft of the creator. However, if the stone is not important aesthetically but the importance lies in the person commemorated or an association with that person, recutting may be acceptable.

A more extreme alternative to (d) is option (e). Again the creation of a replica may be

difficult to achieve and in some opinions undesirable. However, if by this means an aesthetic concept of merit is continued the option must not be dismissed. Furthermore it does present the opportunity to preserve the original stone by removing it to a museum or burying it beneath the replica, where it is protected from further wear.

Again, if replacement is unavoidable option (f) may be looked upon more favourably than options (d) or (e). It can be better to continue the historic or associated importance with a new stone but with a newly designed inscription. This option, incidentally, fosters present day craftsmanship and talent. This option can secure the preservation of the original stone as in (e).

Option (g) has obvious disadvantages for the stones will no longer be visible. It is possible that some form of transparent coating will be available in the future but at present such a coating does not exist.

Most liquid coatings are impervious and to seal the upper surface of the stone can lead to disastrous deterioration of the stone. Similarly glass or plastic sheets, besides inevitably becoming cloudy through scratching could seal the stone surface. Certain floor matting can provide protection but care must be taken that the fibre itself does not scratch the stone or that debris falling through the mat does not become an abrasive between mat and stone. Of course, any form of protective matting with an impervious backing, e.g. rubber, must never be employed.

Finally option (h) may seem to be one of despair and may be forced upon those responsible because no means can be found to fund the costs of the other options. However, the option does secure the historic continuity of the floor and lack of intervention will be seen by some to be the correct answer.

If the chosen option involves any movement or removal of existing ledger stones, or indeed the disturbance of any floor, the archaeological implications must be faced. An archaeologist must be informed and must provide a report on any material discovered beneath the stone. Such reports will then be part of the detailed account of any alterations eventually made.

Eight options have been considered, other courses of action may exist in some circumstances but no decisions can be taken without the existence of the complete survey and record described earlier in this chapter. The account has been primarily of the survey at York and subsequently the Cathedrals Fabric Commission has published a comprehensive 'Code of Good Practice'. At York the survey is complete and the record lodged safely with the Archives. Now the decisions can and must be taken. The onslaught of tourism is not likely to diminish and unless action is taken soon many stones will have become smooth with only traces left of the original inscriptions.

In 1805, the *Gentleman's Magazine* published an article relating to the pavement of St George's Chapel, Windsor. It read:

> The pavement has been new laid, and in the modern way; that got rid of was remarkable for the number and variety of sepulchral stones, inlaid with highly-curious and valuable brasses, rendering a choice display of historical and characteristic memorials, and at the same time admirably accompanying the rising walls on every side. What became of these relics I shall not set about to declare; why need I indeed express any concern for their loss, other than as an Antiquary? No line of ancestry is broken to which I am a distant branch. What is it to me who were the ancient Religious of the pile or how their robes adorned them; such members being out of recollection, and such vestments useless.

We today may envy the positive quality of the opinions of the antiquaries of the early nineteenth century but we surely do not share them and now must take the decisions concerning the preservation of those precious memorial stones which still exist.

7

The surveyor's approach to recording floors

Ross W.A. Dallas

The land surveyor is nowadays involved in many areas of measurement. At first sight, the surveyor's potential role in measuring and recording floors may not be particularly obvious. The areas involved are often quite small, and access is generally very good. Nevertheless, the principles behind measured survey can be very important in assisting and executing such work. In this chapter, a description of the more commonly available measured survey techniques will be given, followed by some examples of how these methods have helped in specific recording projects.

7.1 Producing an accurate survey

Perhaps the first consideration should be to examine the question of the *accuracy* of any work carried out. Many persons preparing measured survey or photographic records fail to appreciate how important the topic of accuracy can be. Yet at the same time, a common complaint in using older survey material is that the current user has no idea of the accuracy of the original. Thus it becomes very difficult to use that material in association with a modern survey. Subtleties of form and construction will often be revealed by accurate measurement. A very small re-alignment in the direction of stone floor slabs could well reveal a change in build. To aid the repair and conservation process, for example if an extensive area has to be lifted and relayed, it will be vital to be able to rely on the plans.

An understanding of accuracy is a complex matter, and the following is a much simplified way of looking at the problem. Textbooks listed in the Suggested reading section explain the concepts in much greater detail. Having said that the survey should be accurate, there is a conundrum in that there is no such thing as absolute accuracy. For example, it is rare to deal with stone slabs or blocks of stone which have sharp arrises. Inevitably, the edge will be rounded to a certain extent. The arris can be considered as an arc (Figure 7.1) and the degree of rounding or wear of that arc may vary from 5 mm to 20 mm. Therefore a measurement taken to the 'edge' is immediately subjective. Similarly, no instrumentation is perfect. Electronic distance measurements (EDM) may provide a reading to three decimal places, i.e. to the nearest millimetre, but all such instruments are subject to certain in-built errors. The manufacturers always quote these instruments as having an accuracy to a certain tolerance.

To account for the above factors, when a land surveyor gives a measurement it is always given with some element of tolerance. Thus the indicated measurement on site might be

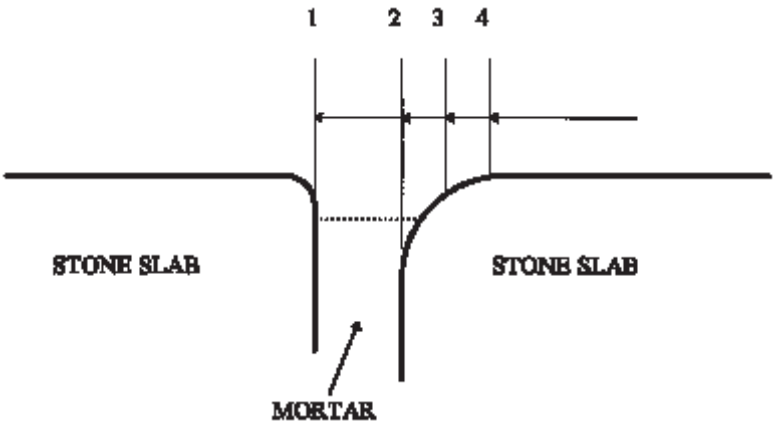

Figure 7.1 Measuring to stone floor joints. One slab has a sharp arris, the other is much worn, and there is later mortar in the joint. Where should the measurement be taken to – point 1, 2, 3 or 4? There is no 'right' or 'wrong' answer, but the readings could differ by ±20 mm

8.25 m, but according to the care and methodology used for the work, this measurement might be 10 mm shorter or longer. Thus the reading should be expressed more correctly as 8.25 m ± 10 mm. In practical terms at 1 : 50 scale, accuracies can be represented on paper to no better than ± 10 mm. In theory, at 1 : 20 scale, accuracies can be presented accurate to ± 4 mm. In practice for most architectural features, this is an unattainable level of accuracy.

7.2 Methods of measured survey

For a general explanation of the principles of measured survey, and for practical descriptions of how to carry out many processes, there are numerous textbooks and primers available. Some of these are listed in the Suggested reading section, as are sources for obtaining such textbooks. The best way to learn the techniques and skills of measured survey is 'on the job' through practical experience gained with a skilled person. The purpose of this section is to indicate the broad areas where certain approaches are most applicable. Measured survey can be considered in three fields: hand survey methods, instrument survey methods and photographic based methods. As will be shown, all these methods can be mixed. Also, it may not always be possible to use the most appropriate method. Site, personnel and financial considerations may well influence the matter. In recording an extensive area of stone floor, work with a total station theodolite might be most appropriate. However, limitation of funds could cause this to be too expensive, thus necessitating the use of much simpler hand survey methods. Similarly, the best method of recording a ledger stone will normally be photographic. There could, however, be occasions when laying a sheet of drafting film over the stone and making a one to one trace is most appropriate.

7.2.1 Hand survey methods

We use this expression to describe a measured survey by no more complicated and sophisticated equipment than measuring tapes, plumb bobs and levels. Over a fairly small area, taping methods will often be quite appropriate. This work is carried out by triangulation with the tape, or possibly by setting out a grid.

Typically, a small chapel (Figure 7.2) might be surveyed as follows. First of all, an overall accurate shape would be established. This is best done with a geometrical figure called a *braced quadrilateral* – which is not so difficult as it sounds. Four corner points are established, then as well as measuring the distance between these points, measurements are taken *across*

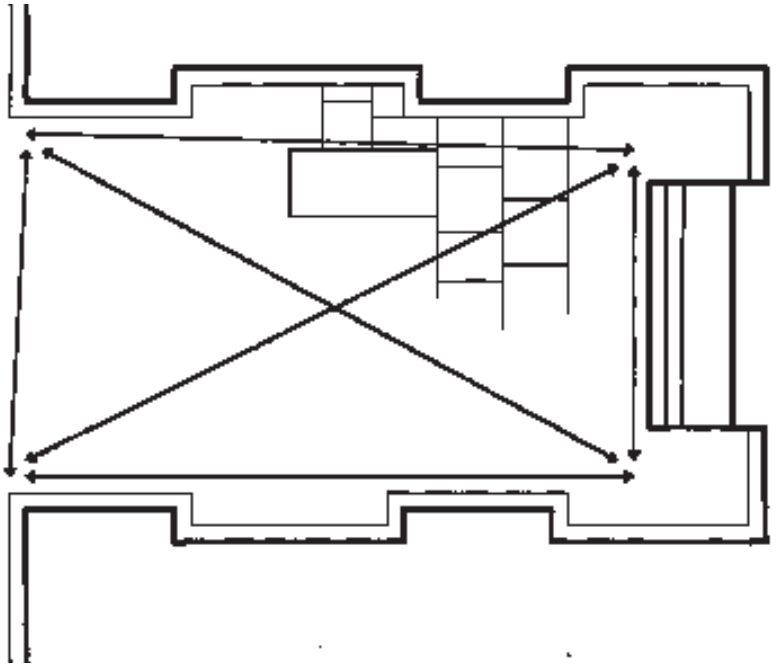

Figure 7.2 Measuring up a small chapel, by 'hand survey' methods. The accurate overall shape is established by measuring a *braced quadrilateral*. Then, by a variety of different methods, the detail of the floor can be measured in

the area in between. The lengths can then be plotted out with a ruler and compass. Then, detail can be measured in by *offsets* for the structural form, and for the flooring by running tape lines from side to side, noting where the tape crosses the main lines of the survey. The precise method does not matter too much, and again reference should be made to the appropriate textbooks for an understanding of the principles of geometry involved.

Such a method of measurement will be quite restricted in terms of accuracy. Over an area of say 10m × 10 m accuracies to within ± 15 mm are quite achievable. If the area extends to much greater than this, it becomes much more difficult to ensure a consistent level of accuracy. Locally, the measurement of one detail to another will remain to the same high standard, but overall it is difficult to maintain a consistent standard.

7.2.2 Instrument survey methods

This expression is used to describe a survey carried out with instruments such as the theodolite, and nowadays with electronic distance measurement (EDM) equipment. The theodolite has been an instrument available for many years, but in recent years huge strides have been made with the instrument through the application of electronics. Now, instead of laboriously writing down the angles recorded with the theodolite, these are recorded at the touch of a button. The process is not only quicker but more reliable, for with the traditional theodolite many errors in survey were caused simply by wrongly booking readings, for example writing down '74' instead of '47'. With the electronic logging of data, such problems are largely eliminated.

Similarly, EDM instruments have revolutionized the way in which distances are measured for survey. The device sends out a beam which is reflected off a prism back to the instrument. This equipment has had a huge influence on many survey procedures. Errors due to blunders are virtually eliminated and very large numbers of readings can be made very rapidly. EDM can now be used economically for observations down to a few metres in length.

The combination of the electronic theodolite and EDM gives the total station theodolite. The readings of angle and distance are downloaded into the electronic data logging device. Then, this information can be fed into a computer. The computations are made in the computer and the result can be output directly onto paper or film. Thus the process is speeded up and many sources of error eliminated. Such instrumentation can be used in itself to create the totality of a survey. Alternatively, the instrument can be used to create a very accurate controlled framework for the survey, with the detail inside this being supplied by hand survey methods.

The total station theodolite is not a panacea for all the problems of surveying. Indeed, it can be quite the opposite. There is a curious belief that the use of this instrument has effectively de-skilled measured survey, thus allowing untrained persons to carry out surveys as effectively and quickly as skilled and experienced surveyors. This is not the case. Even with the best instrumentation, the principles of survey must be understood and followed. Also, while the processes of manually carrying out computations may have been removed, computer and computer-aided drafting (CAD) skills are needed more than ever before. The budding surveyor should not attempt to make use of a total station theodolite and accompanying computer/CAD software without having been on an appropriate training course.

7.2.3 The survey or co-ordinate grid

An important concept relating to survey with instruments is the co-ordinate or control grid. Perhaps the easiest way to appreciate this is by comparison with the Ordnance Survey National Grid. On all Ordnance Survey maps, a grid which looks like large graph paper is superimposed. To record a position on the map, an *Easting* value is read in one direction and a *Northing* value in the other. We say that the point has now been given a co-ordinate reference.

The same grid concept can be applied to any plan or area being surveyed. Particularly when data is being manipulated in a CAD or computer environment, this method can be very valuable. The surveyor uses it in any case for the computations, but it can be adopted by the user of the plans. For example, on an area of mosaic, each square of the grid could be numbered A, B, C . . . in one direction and I, II, III . . . in the other. Each square can then be uniquely identified, and all data concerning that square referenced. Particularly when working with the data in a computer, this approach can be most valuable.

7.2.4 Computer-aided drafting (CAD)

For most small 'hand surveys', graphical methods of presentation were traditionally used. That is, using no more than cartridge paper, scale rules and compasses, the survey was built up on the sheet before inking in. For a small area of survey produced by hand survey methods, this remains the method likely to be used (although the medium of drafting film should be used nowadays).

However, in recent years, computers have entered and changed this activity as well. A CAD system is a piece of software which allows just the same drawing to be built up directly on the computer screen. Indeed, it can emulate the techniques used graphically – a distance can be marked off, then an arc added and so on. When the drawing is complete, it can be output to a printer, just as a word processor file is sent to the laser printer. But a CAD program can do much more. Scales can be changed in an instant, corrections can be introduced in seconds, line weights can be adjusted. However, this is only the start. If the data comes from a total station theodolite, it does not even have to be written down – it can be introduced directly into the program. Then, complex levels of data can be put into separate *layers* of information. These can be merged or separated according to the use to which the drawing will be put. Only a part of the drawing may be used or printed out at a time, by 'windowing' an area of interest.

CAD has actually been available for quite a long time, some programs going back thirty years. What has changed is the cheapness of the programs, their 'user-friendliness' and the cheapness of the computers and plotters themselves. Programs such as 'AutoCAD'™ Release 13 are still expensive, but there are many inexpensive CAD programs now available. From the AutoCAD stable, AutoCAD LT would be more than adequate for many tasks, but there are numerous other programs to choose from.

The early criticism of CAD programs, that they produced very mechanical-looking drawings, is really no longer valid. The appearance of the drawing is a function of how detailed the data introduced, and modern programs can hold far more data than the average project would ever generate. There are, however, some valid criticisms to be made. On a CAD system the lines of the survey can be enlarged and viewed at any scale, even at 1 : 1 or greater. However, it is extremely important to appreciate that the accuracy of CAD generated drawings *can be no better than* the accuracy of the original measurements made on site.

7.2.5 Photographic surveying methods

In recent years, photographic based methods of survey have come to be widely accepted in historic building work. The main methods used are rectified photography and stereophotogrammetry. The first of these produces a photographic image, the second is normally used to create a line drawing.

Rectified photography

The rectified photography process is much the simpler of the two. Photographs are taken parallel to the surface being recorded, with appropriate scale control included. The resulting photographic print, being made to an exact scale, has some of the qualities of a measured survey while at the same time providing a photographic image. This process is extremely valuable in recording many aspects of floors, since a flat floor does not introduce any of the geometric problems experienced when the technique is used on elevations of buildings. A trace-off can be made from the photograph to produce line drawings. The process can also be combined with the other survey methods. With the potential of storing and manipulating images on computer as described further on, the process should prove even more valuable in the future.

The rectified photography process can be carried out by a competent photographer with standard photographic equipment. It is best to use a medium format camera if possible, but 35 mm SLR can be used if no other camera is available. The most important characteristic of the camera is whether it introduces lens distortion or not. This is an effect of bending of the rays of light passing through the lens. If this effect is noticeably present on a lens, it is no good for rectified photography work. All zoom lenses can be ruled out, and most very wide-angle lenses as well. The best way to assess the distortion in a lens is to take a square-on photograph of a modern building facade. If the straight lines of the building seem to be curved on the print, then the lens is not satisfactory for this work.

To take the photograph, it is essential that the film plane of the camera is parallel to the floor plane or other feature. Generally, we assume the floor to be flat or nearly so. The camera must be mounted on an arm on a tripod. Then, a level bubble should be placed on the camera body back and the camera adjusted until the film plane is level, i.e. parallel to the floor plane. A scale bar should also be included in the area of photography, but this should be placed at the edge so that no detail is obscured. Photographic techniques are quite straightforward, reference should be made to Skingle (Chapter 8).

The printing of the negative can be carried out on a standard photographic enlarger, again some careful adjustment being made to ensure that the negative plane is parallel to the easel

plane. Using a scale bar, match the scale in the image to the scale on the easel. This takes a little while to master, but very accurately scaled prints can be made in this way. The whole process can be made more sophisticated and hence more accurate by improving the quality of the camera, the methods of control etc., but for this further study and professional instruction is needed.

Important developments with rectified photography are taking place as a result of computer programs, which allow for digital manipulation of the image. The programs and equipment for this are now available, but inevitably it will take time for these methodologies to become commonly established. With conventional rectified photography methods, removing the effect of any unwanted tilts can be very difficult, but with the image held digitally, it is very easy to 'square up' the image. Also, high quality inexpensive colour printers allow for direct output, in some systems utilizing scanning of the negative without even producing photographic prints. There are proprietary programs produced by photogrammetrists for this work, but also good results can be had with programs from the desk-top publishing sector. It is very likely that even more improvements will take place in this area, leading to the much more widespread use of photographic imagery for floor recording.

A recent example of this comes from the Tower of London, The White Tower. Certain areas of floorboards and joists were exposed before being covered up again during a refurbishment programme. The time available and the quality of the floorboards did not require a full measured survey to be made of the floor. Therefore the floor was recorded with a series of oblique photographs with scale bar, taken in regular strips. This photography was put into store. If at any stage in the future a full record is to be developed, the oblique photographs can be computer scanned, manipulated into a parallel plane, then merged into one whole image of the floor. (This work was carried out for Historic Royal Palaces, Surveyor of the Fabric Department, under the direction of the author.)

Photogrammetry

The photogrammetric process is normally used for the production of line drawings. It is a complex and technical process, utilizing specialist cameras and photogrammetric plotting equipment. It is very valuable in dealing with problems such as inaccessible areas of façades. There is perhaps limited application to floors, since they are generally very accessible. It can, however, be a very rapid way of recording and drawing in some circumstances. Also, if three-dimensional data is required, such as contours of floors, its use should be considered.

The photogrammetric process is certainly one which must be carried out professionally. Nevertheless, some description of the method may be helpful. Photography for the process is usually carried out with 'metric' cameras. Such cameras are either specially made or calibrated for the work. This ensures that their geometric qualities are exactly known. Then, the photographs themselves are taken in stereo. That is, each area of subject must be included in two photographs from different viewpoints. Normally, the cameras are set up parallel to one another, so that the image can be viewed in three dimensions.

The photography is placed in a special instrument known as a *photogrammetric plotter*. The operator of the machine can then trace architectural or other detail from the stereo image. Perhaps the most important point to make is that there is nothing automatic about the extraction of the data. All the points and lines in the drawing must be observed and recorded by the person operating the machine. For floors, the process is perhaps limited, but below an example of recent work at Westminster Abbey is described.

A most important consideration with both photographic techniques is the scale of the original negative. For a final product at say 1 : 20 scale, the photographic negative should not require enlargement greater than four or

five times. Therefore it should be no smaller than 1 : 80 scale. Generally speaking, the larger the scale of the original negative the better. The scale of the negative can be calculated by dividing the distance to the object by the focal length of the lens, or more directly by measuring a distance on the object and comparing it to the same distance identified on the negative.

7.3 Examples

7.3.1 Lichfield Cathedral – the Library floor

One of the first major examples of floor recording using modern measured survey technologies comes from Lichfield Cathedral. This concerned making a record of the Library floor at the Cathedral. This work was carried out in 1988 by the Photogrammetric Unit of English Heritage, then under the direction of the author. The purpose of the work was to prepare documentation of the floor, which would assist in conservation and archaeological investigations. The investigations are more fully described by Rodwell (Chapter 2).

Here, the problems of recording were compounded by the presence of substantial bookcases covering much of the floor. This made the photographic technique particularly important for long-term evaluation. A rectified photography technique with a control scheme was utilized, with some forty photographs being taken. These were presented individually in black and white at 1 : 5 scale, along with grid sheets with control points. A line drawing at 1 : 5 scale was then traced off by the archaeological consultant, Dr Warwick Rodwell. As well, colour photographs were mosaiced together into one large block, which was then re-photographed to show the whole floor in colour at 1 : 10 scale. A sample area of the floor is shown in Figure 7.3. This work was instigated by Dr Rodwell, in association with the Cathedral Architect, Mr Martin Stancliffe, on behalf of the Dean and Chapter and with financial help from English Heritage.

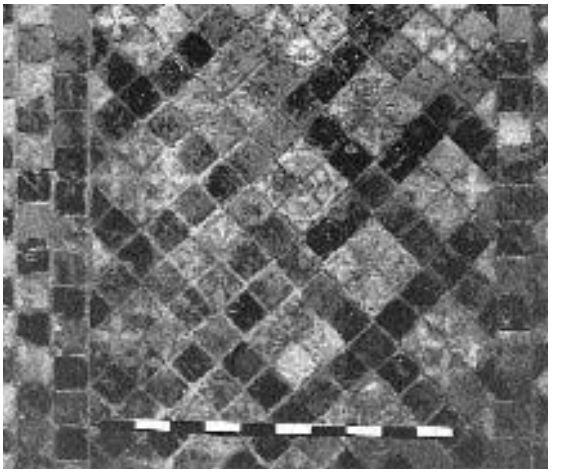

Figure 7.3 A sample of rectified photography from Lichfield Cathedral. The scale bar placed near the edge of the photograph can be seen. As well, co-ordinated points were measured, which enabled the whole floor to be presented as one accurate photographic mosaic. (Photograph, English Heritage)

7.3.2 Winchester Cathedral – retrochoir floor

The work to record Winchester Cathedral retrochoir floor (Chapter 12, Plate 27) was specified by the author, an example of the product obtained being illustrated in the above chapter. Here, the principal method used was again rectified photography. Nearly 200 photographs were taken with the camera pointed vertically downwards. The layout was arranged to provide 'runs' of photographs of the floor tiles, with extra photographs being taken specially to record the ledger stones. The negative scale obtained was 1 : 30. This enabled prints to be produced at 1 : 10 scale.

All photography was taken in colour and in black-and-white negative films. In addition, a control grid scheme was provided by total station theodolite. This provided four co-ordinated points per photograph. This enabled all the photographs subsequently to be mosaiced to provide a record of the whole floor in nine sheets. The process provided both a record and practical documentation for the architect and conservators. The work was

procured on behalf of the Dean and Chapter under the direction of the Cathedral Architect, Mr Peter Bird. The work was carried out by a survey company specializing in photogrammetric applications, Atkins AMC.

7.3.3 Salisbury Cathedral – Muniment Room

The medieval tiled floor of the Muniment Room at Salisbury Cathedral was photographed in colour using a 5" × 4" format monorail camera with the film plane set to the horizontal (Plate 26). A total of forty-four negatives were exposed of the floor, plus a further four of the adjacent landings and window sills. Owing to the irregular surface of the floor, no attempt was made to mosaic the photographs. Instead, they were printed to 1 : 5 scale, trimmed and positioned before being re-photographed and mounted on four boards forming a 2 m × 2 m display.

Owing to the large amount of furniture in the Muniment Room, this photographic record is the only means of 'seeing' the entire floor. The photographic record was produced as part of an investigation into the future of the floor, with the photographic boards eventually going on public display. The work was carried out under the auspices of Michael Drury, the Surveyor of the Fabric at Salisbury Cathedral, by The Downland Partnership. (Section contributed by Mr David Stevens, The Downland Partnership.)

7.3.4 Westminster Abbey - The Great Pavement

The Great Pavement at Westminster Abbey was laid between 1267 and 1269 in the Cosmati style, comprising different marbles and glass set into an unusual pattern of circles and squares connected by a guilloche pattern. The Pavement has remained covered for some considerable time in order to protect the Cosmati work. In 1996 the Dean and Chapter instructed the Cathedral archaeologist, Tim Tatton-Brown, to carry out an investigative survey of the pavement and make recommendations for its future conservation. A photogrammetric approach was chosen by Tatton-Brown to survey the floor (described and illustrated in Chapter 3), in order to produce an accurate line drawing upon which the archaeological, geological and historical studies could be based.

The photogrammetric drawings were produced from metric photography taken using colour transparency film. The camera was mounted on a special trolley designed to prevent damage to the uncovered floor. A network of control points was established on a grid aligned with the central axis of the Abbey. The control points were highlighted with small easily removed coloured markers, which were temporarily left in place to assist with any subsequent measurement by the investigation team.

The photogrammetrist's task was both to plot the outline of over 50 000 pieces of material forming the Pavement, as well as to identify the type of marble or glass by reference to colour and texture. At the completion of the photogrammetric stage, the data was transferred to 'AutoCAD' format for rendering and for the inclusion of the evidence resulting from the investigation team. The project was carried out for the Dean and Chapter by The Downland Partnership. (Section contributed by Mr David Stevens, The Downland Partnership.)

7.4 Conclusion

This chapter has set out to demonstrate that methods of measured survey and photogrammetry from the land survey sector can have great applicability to the recording of floors. Indeed, almost all methods of measured survey may have their place. Some of these methods may be used and adopted by architects, archaeologists and conservators – some must be carried out by professional surveyors. It is important to use the right technique, and to recognize the limitations of non-specialist staff or the lack of the right equipment for the

job. Finally, a good measured survey product should have a life measured in decades, not months. Such a survey will be an investment whose value will be repaid many times over.

Acknowledgements

The author would like to thank his colleagues in the field of historic building measured survey, while stating that all views are of course his own. In particular, he would like to thank the various Cathedral authorities and their Architects, all named in the chapter, for permission to describe and illustrate projects. Also, Mr Colin Briggs of the Surveyor of the Fabric Department, Historic Royal Palaces, for permission to describe the Tower of London example, Mr Paul Bryan of English Heritage for assistance with the work on Lichfield Cathedral, Mr Mike McKay of Atkins AMC reference the Winchester material, and Mr David Stevens of The Downland Partnership for assistance with the examples at Salisbury and Westminster, are all thanked individually.

Suggested reading

Some textbooks are listed which will provide basic and advanced information on the principles and practice of land surveying. Please note that there are many other books and booklets on surveying, many of which contain relevant material.

ALLAN, A.L. (1993). *Practical Surveying and Computations (2nd Edition)*. Butterworth-Heinemann.

CLANCY, J. (1991). *Site Surveying and Levelling (2nd Edition)*. Edward Arnold.

ESTOPINAL, S.V. (1993). *Guide to Understanding Land Surveys*. Wiley.

WHYTE, W.S. and PAUL, R.E. (1985). *Basic Metric Surveying*. Butterworth.

Although it has been published for some time, Chitham is still a very useful reference to hand survey methods, especially as seen from the architect's perspective.

CHITHAM, R. (1980). *Measured Drawing for Architects*. Architectural Press.

For information on rectified photography and photogrammetry, see the following, which also provide many further references to the field:

DALLAS, R.W.A. (1996). Architectural and archaeological applications. In *Close Range Photogrammetry and Machine Vision* (K.B. ATKINSON, ed.) pp. 283–302, Whittles Publishing.

STEVENS, D. (1992). Photogrammetry. In *Monitoring Building Structures*. (J.F.A. MOORE, ed.) pp. 32–67, Blackie.

There are a number of small books and chapters on surveying produced by archaeologists and building recorders. A useful review of survey methods from an archaeological standpoint is contained in:

ADKINS, L. and ADKINS, R.A. (1989). *Archaeological Illustration*. Cambridge University Press.

Good sources for the purchase of books on measured survey are The RICS Bookshop, 12 Great George St, London SW1P 3AD, and The Building Centre Bookshop, 26 Store St, London WC1E 7BT.

8

Photographic recording of floor surfaces and components

Robert Skingle

Making a photographic record of floor surfaces or their individual features is desirable for a number of reasons. A clear image can be made relatively quickly of what may be a long and complicated inscription needing translation or deciphering. Detail of this nature may be of low definition, but contain a great deal of important information. A photograph provides a record of the condition of the subject at a point in time, enabling a future assessment to be made of the rate of deterioration, if any. Using carefully controlled lighting, worn details may be revealed which otherwise would be difficult to observe in situ. Mapping techniques can be used to reconstruct complete floor patterns, and rectified photography can provide accurate measurements for the preparation of survey drawings.

Indeed, the use of photography may seem so self-evident that further description is not necessary. However, photography of floors, for example in a dimly lit church, can be a technically demanding exercise. Even good 'snapshots' can be difficult to achieve in a church interior.

Generally, photography can be considered under two headings. The first will be all-purpose photographs, to illustrate a report or a lecture, or to be used simply as an aide mémoire. The other will be the more detailed and demanding record photographs, needed as a tool for conservators and architects' specifications, and to provide a record of condition and appearance in their own right.

In such a wide-ranging field, there are many possibilities to consider in terms of who will take the photographs and what type and standard of photography might be required. All photographic records will be of value, but the users and takers of photographs must be realistic. While many modern cameras designed essentially for the amateur market can produce superb results, recording floors can still be technically too demanding for such equipment.

8.1 General photography

For the first category of general photography, the standards and possibilities are so wide-ranging that only the most general comments will be made. Such photography in showing the context of a floor is nevertheless important, so some general views of context should always be taken. Some colour transparencies will always be of value.

There are numerous excellent photographs of buildings' interiors in which the floors (and often the ceilings) are just not readable. Therefore, be sure to instruct the photographer to make sure that the *floor* is the vital part of the photograph. This may involve selecting a high viewpoint, or making sure that good lighting and adequate depth of field are set,

or ensuring that half-a-dozen photographs are taken, where one would have sufficed for the room elevation.

8.2 Record photography

This chapter is, however, more concerned with making record photographs of floors and their features. Here, the subject becomes technically much more demanding. The amateur with small format 35 mm equipment can make a very useful contribution – at the very least, any record is better than none. But if a significant area of floor is to be recorded, the skills needed and the time taken should not be underestimated.

Record photographs will usually be to a large scale, that is the photograph will often include no more than a few square metres of floor area per photograph at most. For some specialist work, such as decorated medieval tiles, even a photograph *per tile* may be considered. Photographs may be taken as 'high obliques' to the floor, that is at an angle of 70° to 80°. Often, it will be best to ensure that the photograph is taken parallel to the subject. This is a more involved method, requiring accurate lining up of the camera. The set-up techniques are described more fully by Dallas (Chapter 7).

The procurement of photography as a record must also be carefully considered. A professional photographer specializing in architecture and/or scientific photography will often be ideal. Survey companies also nowadays often take specialist photography of this nature. Materials conservators and other specialists such as archaeologists often find it of value to take their own photographs. Agencies involved in conservation, such as English Heritage or the RCHME, often have their own photographers.

8.3 Cameras

For the professional photographer presented with a wide variety of subject matter, there is no universal camera. To some extent, every task defines the equipment which is necessary to complete it. For the serious photographer of architectural subjects, the most useful tool is the monorail or plate camera, with its provision of movements, such as a rising front which allows compensation to be made for converging parallels. This is a common fault in architectural photography when a camera is tilted backwards to include the top of a tall building. However, these cameras are expensive to purchase, quite slow and cumbersome to use and film costs are relatively high. On the other hand, a large area can be captured per photograph, or alternatively a very large negative scale can be obtained. Working with a monorail camera is, however, not for the faint-hearted.

The medium format cameras utilizing 120 roll film sizes are perhaps the best all-round tools for floor photography. With a significantly larger area of film than a SLR 35 mm camera, both greater coverage and larger negative scales can be obtained. Such cameras while heavier are nearly as easy to operate as the SLR 35 mm camera, but have all the up-to-date features such as automatic stop-down of aperture etc.

The SLR 35 mm camera is the smallest type or format to consider, but generally would not be recommended. This is because the short focal length gives a very small scale to the negative, or requires a much larger number of photographs to be taken. If no other camera is available, or the work is being carried out on a volunteer basis, reasonable results can be obtained. However, if a professional photographer is involved, there is no advantage in specifying a small format, for labour costs will be much greater than camera or film costs in any case. Compact cameras are not recommended, except for aide mémoire snapshots.

Considering lenses, very wide-angle and zoom lenses should not be used. This is because these types of lens usually exhibit significant distortion – that is, a 'bending' of the rays of light through the lens, leading to the familiar barrel and pin cushion distortion patterns. Zoom lenses are particularly bad for this, and should be avoided.

Some very wide-angle lenses may not show these characteristics, but they have another problem in that they are very difficult to align parallel to a surface. Whenever possible, normal-angle lenses should be used.

8.4 Film

There are a number of manufacturers of high quality monochrome and colour films. Before choosing a film type, a decision has to be made about the end-use of the image. Colour prints are more easily examined, included in reports and displayed than colour transparencies, although the latter are ideal for lectures. An archivally permanent image can be made by using black and white film, processed and stored under controlled conditions. All films are graded by their sensitivity to light, and given an International Standards Organisation (ISO) rating. Medium speed black and white or colour films of between 100 and 200 ISO are ideal for most recording purposes.

Colour films are designed either primarily for amateur or professional use. Professional film is manufactured to give optimum results from the moment it leaves the factory, and will remain in this condition only if it is stored at a temperature of 13°C or less. For best results the film should be processed as soon as possible after exposure. In contrast, it is assumed that amateur films will be stored at room temperatures after leaving the factory and that the time between exposure and processing will vary. An average allowance is made for this in manufacturing. For critical use, film should be bought in batches, kept refrigerated until needed, and then allowed to warm up to room temperature for several hours before exposure. Colour film especially should be processed as soon as possible after exposure.

Figure 8.1 Floor slab commemorating Godfrey Copley Armiger d.1761, in chancel floor of St Mary's Church, Sprotborough, S. Yorkshire. Lit by electronic flash from the right of camera. Note use of graduated scale outside subject area (Photograph, RCHME Crown Copyright, 1995)

8.5 Lighting equipment

While normal ambient lighting on the survey site may be sufficient to allow photography, the quality of the light is likely to be flat and dull, and some details will not record strongly enough to be decipherable. The subject may be lit unevenly with a shaft of sunlight falling from a window, or it may give the impression of being multi-hued, being illuminated by the sun through stained glass making a sensible colour record impossible. To overcome problems of this nature, and also to allow photography in low light conditions, for example in late autumn and winter afternoons, it will be necessary to introduce some form of artificial lighting.

For a good quality professional standard of work, studio flash equipment is recommended (Figure 8.1). Essentially, this equipment is an

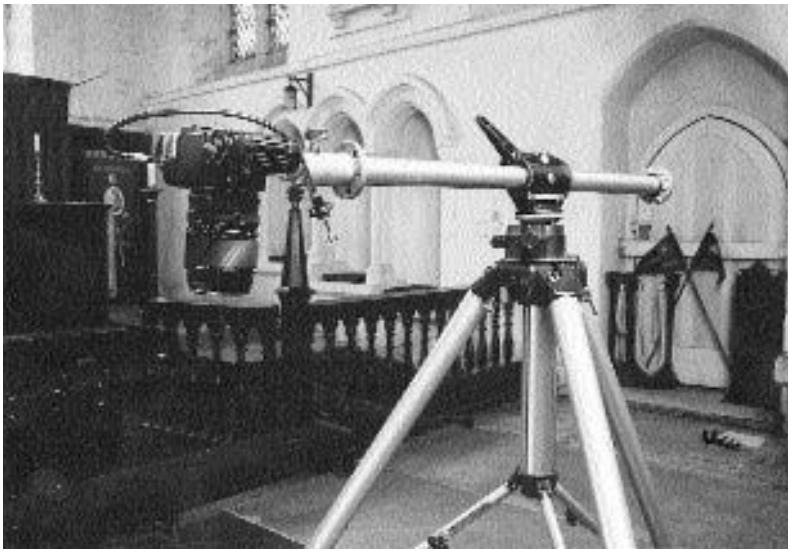

Figure 8.2 A 35 mm SLR camera attached via a ball-and-socket head to a lateral arm on a tripod. A cable release is being used to minimize camera shake (RCHME Crown Copyright, 1995)

electronic flash, but made more sophisticated, powerful and flexible by virtue of the power source usually being separated from the flash head. A wide variety of diffusers and reflectors can be used to precisely control the lighting. Modelling lights around the head enable the lighting of the subject to be carefully assessed. Mobile versions of this equipment can be run off any power source down to a car battery. The equipment is very safe in use, and can be inexpensively hired.

Hand-held flash guns are of limited use and are generally not advised, except for small jobs. They produce a point source of light, and even with diffusers it can be difficult to ensure even lighting. All electronic flash is colour-balanced to daylight, enabling standard films to be used. The intensity and short duration of flash helps avoid camera shake.

Under no circumstances in historic interiors should quartz halogen-type flood lights be used. They can be dangerous, as they become extremely hot in use, and if knocked over the filament can explode. Used, say, by film crews this equipment is reasonably safe, but the recorder of floors will probably be working alone, perhaps with the public present. It is not practical to 'keep an eye' on every piece of equipment.

8.6 Tripods and other support devices

When actually taking the photographs, it is important that the camera be kept still. The shutter release should be pressed gently, not stabbed, as this will result in camera shake. The shortest speed at which it is realistically possible to hand hold a camera is 1/60th of a second. To achieve maximum image sharpness, the camera lens should not be operated at its widest aperture, but rather at f8 or f11.

With long exposures thus necessary, the use of a tripod is essential. A substantial tripod will also allow the camera to be raised by 2–2.5 m off the floor surface, thus increasing coverage. To take photographs vertically downwards without photographing the tripod legs, a bar which will offset the camera from the tripod is essential (Figure 8.2). These can be made up, or proprietary models are available. If much work is anticipated on a floor, the type of substantial tripod or 'dolly' with wheels, as often used for television cameras, can be extremely useful. If greater height is needed, it may be necessary to use a small scaffold tower, or even a 'cherry picker'.

8.7 Lighting techniques

8.7.1 General

To record inscribed and structural details, it is necessary to create the illusion of three dimensions in a two-dimensional photograph. To do this, the subject has to be lit in such a way as to give the impression of 'depth' by the use of shadows. Lighting the subject from the camera position will result in flat and featureless photographs. The light source has to be off-camera, and at around 45° to the subject, normally coming from the side. This will produce a clear and crisp photograph, as illustrated in Figures 8.3 and 8.4.

To reveal very worn details, the light may have to be placed even lower than 45°. At low angles the difference in brightness from one side of the subject to the other may be such that either a second, much weaker, light source is needed, or a sheet can be used as a reflector. If photographing very deep features, the reflector should be used to make sure that the shadows cast have some discernible detail in them. If using hand-held electronic flash, estimating the effect of the light can be difficult. The flash gun should be far enough from the subject to produce an even spread of light, especially when working with wider-angle lenses. Some flash guns need to be fitted with a wide-angle diffuser.

8.7.2 Floor brasses

Photographing floor brasses is probably a more environmentally responsible method of recording them than making rubbings, which process if repeated frequently could result in permanent damage to the brass. Many churches actively discourage brass-rubbing

Figure 8.3 Fourteenth-century floor brass to William Fitzwilliam d.1474, set in the chancel floor of St Mary's Church, Sprotborough, S. Yorkshire (RCHME Crown Copyright, 1995)

Figure 8.4 As Figure 8.3, but a negative image (RCHME Crown Copyright, 1995)

enthusiasts. The photography of brasses, however, represents a challenge, as the light reflecting off the hard shiny surface 'flares'. It can be extremely difficult and sometimes impossible to eliminate this flare completely. Hard or direct lighting should not be used, as any specular reflection from the metal must be avoided, and the surface may be uneven. A soft light source is better, illuminating the subject evenly.

8.7.3 Tiles and tiled pavements

Photographing a tiled surface presents similar problems to those encountered when photographing brasses. Care needs to be taken to eliminate reflection or flare when positioning the light. Reflection can be minimized by using a polarizing filter which is placed in front of the lens, and then rotated until the light rays which have been polarized by reflection from the polished surface are absorbed. The surface detail is then seen more clearly. This filter has no effect on light reflected from a metal surface, since these rays are not polarized.

8.8 Scale and subject preparation

To obtain the maximum information from the photograph, a graduated scale should be included. This could also be combined with a colour scale. This enables a colour print to be made reproducing the image faithfully. This scale must not obscure any subject detail, and should be parallel to the film plane and squarely aligned.

Many brasses, ledger stones and other features accumulate dust and other debris, generated both by their environment and visitors to it. Before photography, careful cleaning using a soft-bristled paint brush can lead to a better result, and sometimes worn details may be more clearly revealed. The temptation to dull polished brass surfaces by the use of sprays or any other medium should be resisted.

8.9 Rectified photography

The method of taking photography with the negative plane of the camera exactly parallel to the floor plane has much to recommend it in recording floors. The technique has, of course, long been used in photography. It can, however, be graded in its application from a fairly approximate method, through to an advanced survey technique. This is described more fully in Dallas (Chapter 7).

For straightforward 'parallel' photography, careful levelling of the camera with a level bubble clipped to the hot shoe of the camera will usually suffice. From the photographic point of view, much care has to be taken with the lighting – any unevenness in lighting will show up much more so than with an oblique view. Otherwise, good photographic practise as described in this chapter will provide satisfactory results.

8.10 Products

It is most important always to remember that *the negative material is the primary record*, and should always be looked after most carefully. For day to day purposes, prints will be used. If for illustration, these clearly need to be of the highest quality. For day to day work in the office, 'machine print-quality' prints may be quite adequate, and are much cheaper. If taking a series of prints, it is highly desirable to print onto standard A4 size paper, even if the image is not this shape. Being able to file the prints along with everything else can be invaluable, and ensures that the material does not become disassociated from the report.

8.11 Storage of the processed image

This topic is fully dealt with under Chapter 10: The preservation of the records of historic

floors. Perhaps the one point to make here is the importance of accurately and carefully labelling each negative and photographic print, before it leaves the photographer's hands. All material should record the site, the feature, the date and the photographer. It may also be useful to record technical details, such as the camera type and aperture settings.

Suggested reading

CONLON, V.M. (1973). *Camera Techniques in Archaeology*. John Baker.

COOKSON, M.B. (1954). *Photography for Archaeologists*. Max Parrish.

DALLAS, R. (1980). Surveying with a camera–photogrammetry. *Architects Journal*, **171**, No. 5, 245–55.

DALLAS, R. (1980). Surveying with a camera–rectified photography. *Architects Journal*, **171**, No. 8, 395–9.

9

The retrieval of damaged inscriptions through remote sensing techniques

Christopher J. Brooke

Ground-based Remote Sensing (GBRS) techniques currently available for the remote examination of archaeological features within historic floors, based upon scientific photo-imaging and digital image enhancement, offer an important additional tool for their investigation and interpretation. The features which are best extracted are those which are either formed by differing chemical composition or by incision below the normal surface. Where anomalies are suspected, but not easily discerned by eye, then remote sensing offers a valuable series of tools to assist in the proper recording of these features.

These methods comprise a series of specialized photographic, electronic, and computer-assisted image processing methods capable of revealing a variety of archaeological, geological, chemical, and structural evidence from building fabric. GBRS systems have been developed through the modification of other scientific imaging processes originally designed to monitor the earth's environment, to investigate the universe, and to assist in medical research. Advances in these fields continue to provide improvements for adaptations in archaeological applications (Brooke, 1987, 1989, 1994a).

There are four basic GBRS techniques which may be used to assist in the examination of historic floors:

(1) Multispectral Imaging
(2) Contrast/Contour Enhancing Illumination (CEI)
(3) Multiple Angle Surface Saturation (MASS)
(4) Laser Surface Profiling (LASP) and Laser Contour Profiling (LCP)

9.1 Multispectral imaging

In practical terms, for the examination of historic floors, this process entails the production of a series of photographic or digital images at differing wavelengths. In this way, a comparison of the resultant imagery may reveal any features which, although appearing similar to the naked eye, have different chemical and/or physical properties. Typically, a series of images is produced which ranges from the near ultraviolet to the near infra-red, and includes 'control' scenes in both colour and black and white

Features are normally revealed by colour or tonal differences when a direct comparison is made between the filtered images and the control photographs. Some form of computer-based image processing is often required to extract subtle tonal differences in a form perceivable to the eye and to assist in the removal of unwanted 'noise'.

Finally in this section, the use of ultraviolet fluorescence should be noted. This technique, normally used in the laboratory for the examination of mineral samples, may be utilized to detect invisible features over larger areas.

Figure 9.1 The floor of the central crossing at Southwell Minster, Nottinghamshire, taken from the eastern tower clerestory stage: as it appears to the naked eye (Photograph, Dr C.J. Brooke)

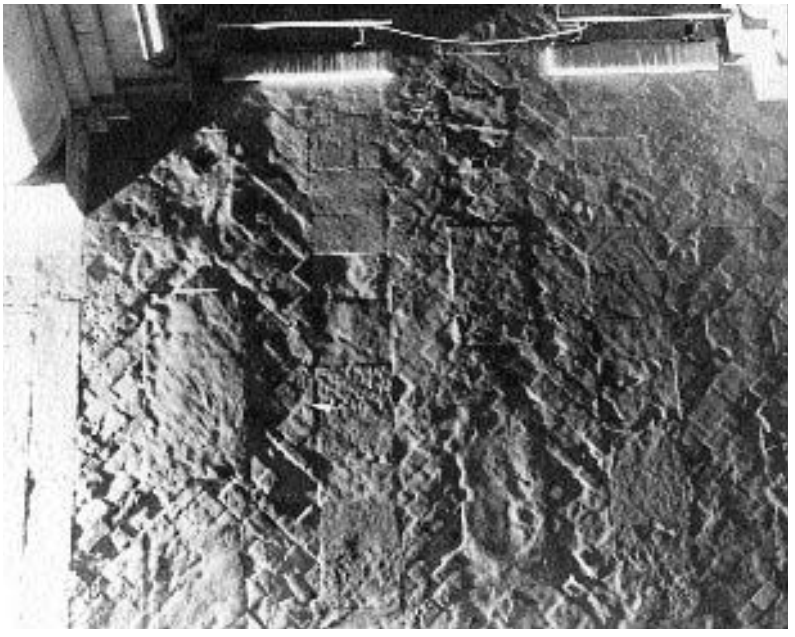

Figure 9.2 The central crossing floor illuminated by CEI, rendering the surface profile more clearly visible and showing the extent of damage and wear (Photograph, Dr C.J. Brooke)

9.2 Contrast/contour enhancing illumination (CEI)

The use of raking light to enhance details of rough surfaces is well known, and well documented (see Chapter 8). Its use in ground-based remote sensing broadly follows the photographic principles used elsewhere to accentuate the contours of a three-dimensional surface.

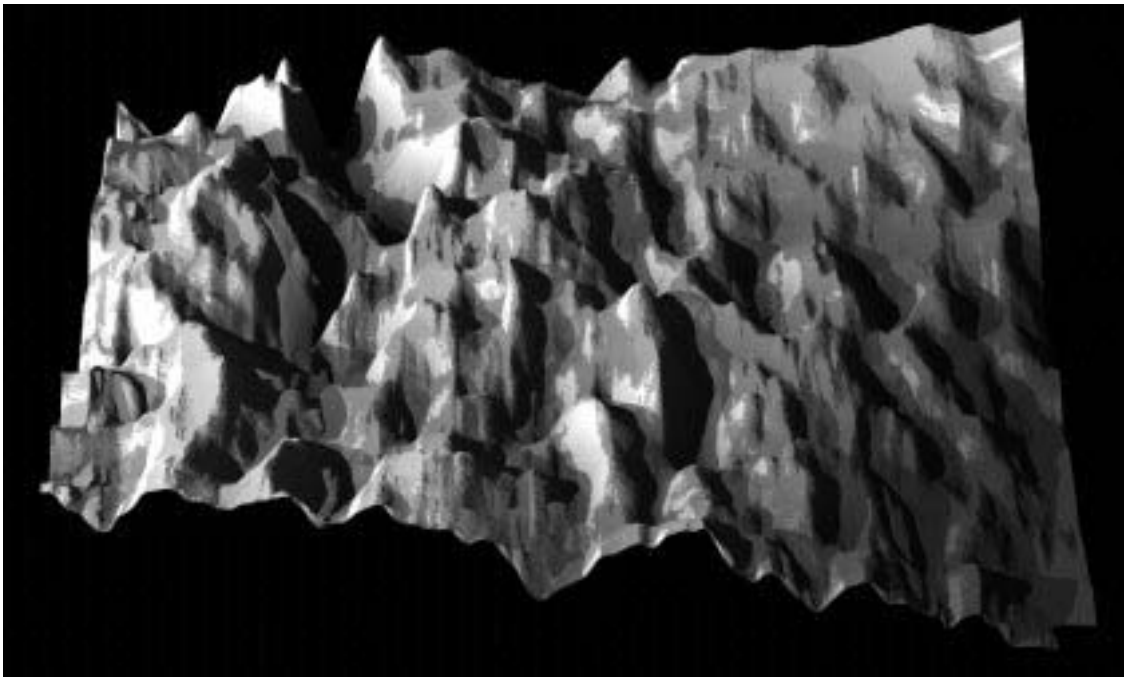

Figure 9.3 A three-dimensional computer rendering of Figure 9.2 illustrating the use of this technique to delineate surface profiles (Copyright, Dr C.J. Brooke)

The technique depends upon the use of an extreme point-source illuminator, typically a powerful electronic flash unit, positioned to one side of the target area. A camera is then placed in one of three positions, either square on to the face of the target, angled away from the illumination, or angled towards it; each position yields different effects as the illuminating beam is scattered from the rough surface. Experimentation is needed to determine the optimum position to obtain useful archaeological or physical information from the subject.

Figures 9.1 and 9.2 show the floor of the central crossing in Southwell Minster, Nottinghamshire. This floor comprises a series of stone paviours combined with re-used grave markers and was re-set during the restoration of the cathedral between 1880 and 1890 (Brooke, 1997). Figure 9.1 is a normal photograph, taken from the eastern tower clerestory at a height of approximately 15 m; Figure 9.2 shows the same area illuminated by CEI from the south side. In the second image the apparently flat floor surface can be seen to be severely contoured in an irregular pattern; the large rectangular blocks of stone appear to show greater wear, and some can be identified as being re-used grave markers.

Using various digital image processing systems, a three-dimensional profile of the surface may be obtained. Figure 9.3 illustrates the area shown in Figures 9.1 and 9.2; the areas which are most strongly illuminated appear highest and the deepest shadows, where the surface is pitted or indented, appear as dips and valleys, revealing where worn, older stone has been reused.

9.3 Multiple angle surface saturation (MASS)

The MASS technique was developed from the CEI and raking light principles as a means of

Figure 9.4 Carved cross face at St Bridget's Church, Beckermet, Cumbria, showing the heavily eroded and largely illegible inscription (Photograph, Dr C.J. Brooke)

Figure 9.5 Beckermet cross face using MASS imagery to produce an enhanced image of the inscription (Photograph, Dr C.J. Brooke)

more clearly discerning incised inscriptions and decorative carving. It is based upon the use of extreme angled illumination, but instead of using just one angle MASS employs multiple angles of incident radiation within the same image.

A normal photographic camera is set up to face the floor as near perpendicular to the surface as practicable. In total darkness the camera shutter is opened and point-source illumination from an electronic flashgun is directed from all four cardinal points at an extremely shallow angle relative to the target; better results may often be achieved by also providing illumination on the diagonals as well.

The technique works by gradually eliminating all surface anomalies and irregular erosion as each is illuminated from at least one direction; any deliberate artefacts such as carving or incised lettering remain below the illuminated surface and are revealed in the final imagery as such.

Figure 9.4 shows one of the pre-Conquest carved crosses at St Bridget's Church, Beckermet, Cumbria, as seen by the naked eye. The inscription is heavily worn and partly covered by lichen and moss growth. Figure 9.5 shows the inscribed face using MASS to reveal the majority of elements present in the inscription.

9.4 Laser surface profiling (LASP)

The technique of Laser Surface Profiling is an extension of the ideas embodied in the MASS method. Here, a laser replaces the point source flashgun and instead of being used at discrete angles relative to the object surface,

the beam is swept through 360 degrees across the face of the target.

There are distinct advantages to using this method over the pulsed light source as the laser beam produces a better photographic end-product. The disadvantages are that the technique is more difficult to perfect, and it requires stringent safety procedures to be in place.

Despite the operational difficulties of the LASP method, results have provided exceptional image quality in the examination of grave markers and monuments (Rodwell, 1989, pp. 174–5; Brooke, 1994b).

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10

The preservation of the records of historic floors

Mark Dorrington

10.1 The creation of records

Records created in the recording of historic floors have a variety of formats. These might include record sheets and cards, plans, drawings, rubbings and photographs. Each record type presents differing preservation and storage problems, requiring different solutions.

In order to ensure their long-term preservation, records should be created using the best quality archival materials. Paper and card should be lignin free with an alkaline buffer, meeting the requirements of ISO 9706: 1994 (E). Drawings should be made on polyester draughting film, linen or archival quality paper, using permanent black ink and not dry-transfer lettering which can easily become detached, adhere to other drawings and cause damage to the paper on which it is stuck.[1] Photographs should be taken using a suitable film, and if colour the slowest possible film speed, and processed to archival quality standards with a double final wash.[2] Owing to the impermanence of colour film, black and white photographs should always be produced as an additional record of greater longevity.

10.2 The storage of records

The storage of record cards and sheets, provided they are produced on good quality paper, should not present any significant difficulties.[3] Plans, drawings, rubbings and photographs, however, because of their different formats and sizes, present a more complex problem.

10.2.1 The storage of plans, drawings and rubbings

The comparative size of many of these records makes their storage more problematic and damage from mishandling much easier. Flat, unrolled and unfolded storage is recommended.[4] This will prevent the risk of strain and distortion which is particularly important with plans and drawings of accurate scale. Plan chests or shelves fitted with drawers should be used but the drawers should be of a shallow depth of no more than 40 mm and not overfilled. Metal cabinets with baked-on paint are preferable to wooden ones which, if used, should be lined with archival quality paper.

[1] The preparation and storage of working drawings is discussed by Brown (1995, Appendix 1).
[2] Procedures for the archival processing of photographs are given in Appendix C of Collings (1983).
[3] Standard practice is provided in BS 5454 (1989).
[4] The storage of outsize documents is discussed in BS5454, 9.8 and Brown (1995, Appendix 1).

If there is no alternative to vertical cabinets, hanging plans, drawings or rubbings should be supported for their whole width to prevent distortion. This can be done by having them mounted on guards by a conservator and attaching supports to the guards, but never directly to the document. Alternatively individual items can be stored in suspension sleeves. Although hanging cabinets can accommodate a large number of documents and allow relatively easy reference and retrieval, because of the problems of distortion and the fact that supports can become detached and documents crushed and damaged at the bottom of the cabinet, flat storage is always preferable.

For very large plans, drawings or rubbings, rolled storage is probably the only solution but the shelving should be designed to allow the support of the full length of the rolled document. This can be facilitated by placing the rolls in single rows, on double-sided shelving, at right angles to the gangway or on specially designed cantilevered shelves. Documents should be rolled around acid-free cardboard or polypropylene cylinders and wrapped in archival cloth with flaps of sufficient length to tuck into the ends of the cylinder to exclude dust. Alternatively they can be placed in rectangular tubular boxes.

In order to reduce damage from unnecessary handling it is recommended that references be placed on plans, rubbings and drawings, in pencil, on diametrically opposite corners of the reverse of the document, on tags where stored rolled and on both lids and boxes where boxed. It is also preferable, for ease of handling, to store these outsize documents as near as possible to the area where they are to be consulted.

10.2.2 The storage of photographs

The environmental requirements for the storage of photographs are far more stringent than for paper records. However, recommendations on temperature and relative humidity in the current literature vary widely (see Clark; Collings, 1983; Edwards; Kodak, 1985; Rempel, 1987). In general terms the lower the temperature the slower the rate of chemical deterioration. Stable conditions between 15° and 20°C and between 30 and 50 per cent relative humidity are regarded as acceptable in the British Standards (British Standards Institution, 1996). However, added protection would be achieved at lower temperature storage and the British Standard recommends a temperature of below 2°C for colour photographs due to the impermanence of their dyes. To achieve this, colour prints should be conditioned to the recommended relative humidity, placed in hermetically sealed enclosures in a deep-freeze unit or in a storage room controlled at 2°C. The latter solution, however, would require extremely expensive equipment and low relative humidity is difficult to maintain at low temperature. In general archive repositories some sort of compromise will usually be necessary and, although not ideal, if a deep-freeze unit cannot be used a constant temperature of between 8° and 12°C will usefully extend the life of colour photographic materials. However, where photographs are required for frequent consultation extreme low temperatures should be avoided as rapid changes of temperature when transferred from repository to reading room will produce condensation. To prevent moisture condensing on the print the temperature and relative humidity of photographic enclosures should be raised gradually prior to opening and lowered again before return to storage.

Pollutants in the atmosphere such as peroxides, ozones, sulphur dioxide, hydrogen sulphide, nitrogen oxide, ammonia and acidic fumes which are harmful to photographs can only successfully be filtered out by an air conditioning system, although storage in sealed enclosures will afford some protection.

The provision of a small photographic store within an archive repository with environmental conditions suitable for a mix of photographic materials should be possible if a

compromise of the various environmental conditions is accepted, even if deep-freeze units, portable dehumidifiers and room air conditioners are used.

Where environmental conditions are less than perfect the quality of the storage materials used becomes even more significant. Photographic materials should be stored on metal shelves or in filing cabinets or drawers with a baked enamel finish, as some woods and new paint emit harmful peroxides. Original photographic enclosures such as print boxes and glassine envelopes should be discarded and replaced with materials of archive photographic quality. Photographic boxes and boards should be sulphur and lignin free with a neutral pH and consequently free from the alkaline buffer usually present in acid free materials. Plastic sleeves should be made from polyester or polypropylene and never PVC. Prints should be stored flat in archival photographic boxes and can be given further protection from external climatic change by storage in polyester sleeves and additional support by inserting a piece of photographic archival board behind the print. Prints provided with this additional support can be hung vertically in polyester or polypropylene sleeves in filing cabinets. Negatives and transparencies should never be stored flat but vertically in polyester or polypropylene sleeves in filing cabinets or photographic archival boxes.

Consideration should be given to providing a copy for use as a reference print. Cotton gloves should also be worn when handling any original photographic material to prevent contamination of absorbent emulsions by dirt and grease present on even the cleanest of hands. The surfaces of negatives and transparencies should not be touched as this will degrade the image. Repeated or prolonged exposure to bright light will cause colour dyes to fade and should consequently be avoided. This is particularly so with the frequent projection of transparencies and consideration should be given to providing duplicates of important images.

10.3 The deposit of records

The records of historic floors should be transferred as soon as possible after their creation to a repository which can meet the environmental and custodial standards of British Standard 5454 and The Royal Commission on Historical Manuscripts (1990). Ideally this should be the same repository which holds other archives relating to the building or of its governing institution. The repository should be able to provide the storage conditions and materials outlined above, produce catalogues and indexes to the records and facilitate supervized public access. If appropriate, security copies should be made of essential documents for storage elsewhere as a precaution against disaster. In this way the records of historic floors will be permanently preserved for the benefit of future researchers.

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11

Records and computerization

Diana Hale

The main objectives in computerizing records are to provide rapid and flexible means of accessing and delivering information on the one hand and to aid conservation of records on the other. Computerized records can be manipulated and linked in ways not possible or not practicable with conventional paper-based forms. Copying of records, whether for security or for dissemination, is made easier and may be done more economically. Savings may be made in archive storage space and original material will not need to be handled as much. It is important to determine particular objectives to ensure the most effective methodology is adopted.

Computerization of records relating to historic floors may include both information originally created in another form and transferred, that is retrospective digital data capture, and records in which the computer record is the only form existing. The latter may result from the use of digital technology in the survey process, whether digital cameras, computer aided drafting or text input. Computerized records may just consist of text but may also include visual material, that is photographic images and drawings, and various combinations of media if in the form of electronic publications such as CD ROMS.

The possible range of formats and media is now extensive and their use becoming widespread. This requires careful consideration to ensure continuing availability of, or access to, information and its archival preservation in the long term.

As yet there is little readily available guidance in the form of generally applicable standards and recommendations (British Library and British Academy, 1993; Robinson, 1993; Cathedrals Fabric Commission, 1995). Some conclusions for best practice can be drawn from a consideration of the issues involved and how these may be resolved.

11.1 Content of computerized records

It is important to consider the amount of information or level of detail that needs to be in computerized form. This should be kept to a minimum. There may be a difference between what is required during the course of a recording project and what is kept in the longer term, or held in a place of deposit.

11.1.1 Site or monument information

This must include identification of a site and its location, and will usually include dating and typology in some form, as well as architect or craftsman, if known, and construction materials. The sub-location of a floor within a building and of any separate elements recorded, such as ledger stones, should be included. Most computer systems can then be

searched by typing e.g. 'Octagon' to find all entries recorded as that location.

11.1.2 Archive information

This should include archive details such as numeric identification, e.g. negative or drawing number, and formats and content information such as captions or titles for individual photographs or drawings (Porter and Thornes, 1994).

Cross references to other records or bibliographic information may be included. The location or source of records should be given, particularly any drawings or photographs. The many earlier records on the ledger stones of Exeter Cathedral made by Hope are cross referenced in the recent ICOMOS survey, which records the floor position as well as much other new information on each ledger stone.

11.2 Standardization of data

The long-term value of computerized records has suffered as a result of a lack of nationally or internationally acceptable standards for ways of organizing and presenting data. This is changing as various user communities see an increasing need in times of limited resources to make maximum use of work done for one specific purpose, through making data available for other purposes for exchange or re-use and are working towards agreeing standards (Council of Europe, 1995; International Council of Museums, 1995). At York Minster archivists created notes to a standard format and language for each drawing which were then copied onto a database. Guidelines from a variety of sources helped create a dictionary of terms. Many library, archive and museum organizations are able to advise on standards they themselves may use or recommend for particular areas, where there are not specific BS or ISO standards. These may apply to areas of text content such as address, vocabulary controls such as subject thesauri or formats for data exchange (RCHME with the Association of County Archaeological Officers, 1993).

The *Thesaurus of Monument Types* produced by RCHME and English Heritage (RCHME with English Heritage, 1995) provides preferred terms for describing the function of buildings and archaeological sites. Work is also being done on building material terminology, as well as terminology for archaeological objects.

11.3 Forms of computerized records and issues related to each

Computerized records may be held as electronic signals on magnetic or optical media. Any digital data requires special consideration if it is to be kept after being used on its current system. Many archive repositories other than those specializing in digital archives are not yet able to ensure long-term maintenance of digital data, and may be reluctant to take data in this form. This includes many local authority record offices. It seems likely that this situation will have to change fairly rapidly though. If the eventual place of deposit is decided as early as possible during a project requirements can be discussed before work is carried out, ensuring potential problems over the form of records are identified and solutions agreed. The information needed by the repository to accompany the records, such as formats and standards used, can be established.

All working records should be backed up regularly while still in use or kept on-line. Once records are deemed archived copies may be used for working purposes.

11.3.1 Written information

This may take the form of word processed text or structured data held in separate fields or tables in a database form. These are comparatively easy to handle as output files which

may be kept in the digital form if using a widely acceptable word processing package such as WordPerfect, or if output to ASCII format, the closest equivalent to a transfer standard. Hard copy output of word processed text is straightforward and most database packages have report formats to provide structured hard copy. The printed report on the fabric archives of Ely Cathedral and College, produced under the English Heritage grant-aided scheme to record the fabric archives of twenty-two of the English cathedrals (Collins, 1994), shows the form a report from the computerized inventory can take. It includes an index of plans and elevations, topographical views, drawings, photographs and archaeological surveys, listed by the holding institution and giving all the necessary archival information. For the Exeter Cathedral ledger stones survey a database was used during recording but the data is only to be kept in hard copy form, on archival quality paper.

11.3.2 Graphics and digital surveys

Drawn surveys are increasingly carried out using CAD (Computer Aided Drafting) systems. Several different packages are available which produce different results. Microstation™ and AutoCAD™ are widely used. In some cases it may be necessary to use such drawings in their electronic form to make sense of them. This is particularly true of three-dimensional surveys, but also where overlays are used.

As with other electronic records standard procedures for labelling must be in place, in this case for numbering or naming the file. Different versions of drawings need to be identified by numerical sequence and date of latest update, a process known as revision status.

11.3.3 Electronic images

These may include both images originating in electronic form, such as from digital photography or video, and those transferred to electronic form from a conventional original, such as through scanning of conventional photographic prints or slides. Electronic images can be created using many different system and data formats and to many standards. They can be held on a variety of media and, significantly, require considerably more computer space than do text or graphics (Besser and Trant, 1995).

The quality of a conventional photographic image is likely to be greater than that of a scanned electronic version, particularly as viewing screens and printers impose further limitations on quality, unless expensive hardware is available. Electronic photographic processing can sometimes enhance information, for example in improving the legibility of inscriptions. Video or mobile digital cameras cannot at present produce high resolution images. They may be considered to have advantages of ease of use and, in the case of video, cheapness and widespread user acceptability.

Image resolution is a combination of the number of pixels across and down an image. A high resolution image may be necessary to produce a publication quality image, but creates a large computer file. Low resolution images can be retrieved quickly and browsed through or displayed a number at a time, but they may not provide sufficient detail for users and would be inadequate for publication purposes. The number of colours available also affects the picture quality as does any compression method used to reduce file size.

As the cost of some methods of electronic imaging falls their use may be considered worthwhile. Kodak Photo CD conversion of 35 mm film images by a bureau, is now possible at a very reasonable cost. One hundred photographic quality images can be stored on one CD which can be viewed on a monitor or on a standard TV screen using a CD player. One disc could alternatively store 800 images at TV resolution, or up to 6000 small, low resolution images.

While there may be space-saving advantages over conventional paper or film forms, there may be considerable cost in terms of maintenance of

electronic images as the longevity of electronic storage media is unproven at present. If it is necessary or advisable to also maintain records in a conventional form then any benefits of using electronic media will inevitably be at extra cost and may not be justifiable.

11.4 Access

The place of deposit will determine the ultimate form of records held and will have responsibility for providing continuing access to those records accepted. York Minster's computerized inventory of drawings can be queried for users of the archive requiring drawings selected by e.g., architect, date or part of building (Daly, 1995). Data and images may be made available on demand via a network such as the Internet, but will need to be maintained on a host machine and given an electronic address.

Copyright and data protection issues must be clarified and conditions or agreements should make specific reference to computerized forms of data. Licences for continuing use or reproduction may be necessary and all agreements should be written.

Decisions on on-line or off-line storage will depend on retrieval requirements. Frequency and speed of retrieval will affect the methods chosen. For on-line storage where rapid access is important hard disk storage is preferable to floppy disks. WORM (write once, read many times) or rewritable optical disks (which can be updated or added to) are an alternative. They have a large capacity and may be considered as an alternative to microfilm for image storage, or for data as an alternative to magnetic tape or disk. If records are to be stored off-line WORM disks have a longer life than rewritable disks and magnetic tape. They also provide data security as they cannot be accidentally erased or damaged. Optical disks do not need such careful maintenance or environmental control as magnetic tapes. All electronic data will need migrating to new generations of hardware and software for it to continue to be readable in the original form. Records kept on-line with adequate protocols are more likely to be migrated to new hardware and software than those only retained off-line. However, most records are not likely to be kept on-line permanently due to operational overheads.

Computerized records offer many advantages for capturing, storing, manipulating and disseminating information. However, from a purely archival perspective there are limitations which still have to be overcome. The media must be actively refreshed to minimize the danger of corruption and obsolescence.

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12

Winchester Cathedral

Conserving the retrochoir pavement

Peter Bird

The floor of the retrochoir at Winchester Cathedral contains perhaps the most substantial and important area of medieval encaustic tiles, indoors, in the country. A large proportion of the tiles are in situ, undisturbed since they were first laid.

The tiled floor was laid in the thirteenth century, in carpet patterns, using seventeen different type styles of tiles. The history of the floor, and details of the design inlaid in the encaustic tiles is set out in detail in Christopher Norton's study of the floor contained in *Winchester Cathedral – 900 Years* edited by John Crook, who is the Cathedral Archaeological Consultant (Crook, 1993).

The condition of the tiles has been a source of concern for many years; increasing visitor numbers have laid greater pressure on the floor, here, as in the rest of the Cathedral. Even as early as the immediate post-War years, Wilfred Carpenter Turner, the then Cathedral Architect, arranged for a series of record photographs to be taken by C.J.P. Cave, using an ingenious trolley upon which Cave balanced, to ensure that the record be taken from a consistent distance. That record demonstrates the degree of wear which has occurred since the War; for many years a large area of the retrochoir has been roped off to prevent access by the public.

By 1990, the floor was grubby, the detail and the delight of the tiles concealed by a layer of grime, and many of the tiles even in those areas protected from normal wear and traffic were breaking up, and loose bedded. The task of conservation of the floor was included in the programme of repair embodied in an appeal launched in that year, and so the process of recording and planning for a major programme of repair and conservation was possible.

The recording of the floor in its then state was the first priority. Using techniques being developed by English Heritage, and tried with great success on the Library floor at Lichfield Cathedral by Martin Stancliffe and Paul Drury, a series of rectified photographs were taken of the whole floor (see Plate 27). Ross Dallas was engaged by the Dean and Chapter as a consultant for this important survey. The technique, executed by Atkins AMC Ltd, employed a large format camera fitted by means of a long boom to a conventional tripod. The use of the boom, which was counterbalanced, meant that the camera could be kept clear of the legs of the tripod, and avoided the use of complicated scaffolds or other devices to maintain a constant height. The tiles were wetted, to emphasize the colour, and the whole floor was then photographed in black and white, and in colour. The resultant prints were mosaiced, and stuck together to form nine separate sheets at A1 size showing plans to a scale of 1 : 20 of the whole floor. This record

Figure 12.1 Tiles in the central vessel of the retrochoir before cleaning and conservation (Photograph, Cliveden Conservation Workshop Ltd)

forms a permanent basis for future work, and is kept in the Cathedral archive. It was used to produce record drawings of the floor, which could then be adapted for use for planning and recording of the repairs which were to take place.

The approach to the conservation and repair of the tiles was under consideration at the same time. Some similar work had already been carried out under the direction of Martin Caroe, in a small area of medieval tiles in Rochester Cathedral. That approach, employing repair using lime mortar, with some surface consolidation of the tiles was felt likely to be an appropriate solution. A small working party established by the Dean and Chapter, consisting of myself as the Cathedral Architect, John Crook the Cathedral Archaeological Consultant, John Hardacre the Cathedral Curator, and Christopher Norton from York University, an acknowledged expert on medieval tiles and the tiles of Winchester in particular, began to consider this, and the alternatives for repair.

One of the particular perceived problems in the floor at Winchester was the pointing and grouting of quite substantial areas of the floor in a very hard red matrix. These areas were confined largely to the aisles, and were less extensive in the central vessel of the retrochoir, perhaps fortunately since it is the central vessel which contains the largest areas of in situ tiles in the floor (Figure 12.1). It was considered that the red mastic – such it was assumed to be – posed a threat to the survival of the floor because of the preferential drying, and salt crystallization it was felt it would promote. Several areas of inserted modern tiles (dating from the eighteenth century and later) in the floor in these areas were already showing signs of decay as a result of such preferential crystallization. It was considered that the removal of this material ought to be an essential part of the repair programme.

At this stage Trevor Proudfoot and Sue Baumbach of Cliveden Conservation Ltd, the consultant conservation body of the National Trust, were asked to carry out trials on the removal of this mastic, and to advise upon the formulation of a specification for the repair of the pavement. This they undertook with the assistance of Sandra Davidson from the Conservation Studio. Working in two small 1 m^2 areas in the south aisle Cliveden then began a programme of investigation of the matrix, and a trial for cleaning and conservation.

The matrix proved entirely intractable. Removal by mechanical means was just possible, but resulted frequently in mechanical damage to the tile – it adhered so well – and was resistant to chemical, or even thermal methods of removal. One small area of the material around twentieth-century tiles was subjected to high temperature which still failed to make any impression upon the surface.

There is no record in the Cathedral archive of when the work to point the tiles in this material was carried out, nor of its constituency. Analysis by Cliveden suggested that it is a mixture of Portland cement and red brick dust. It was at this stage that a decision was taken to leave the material in place, since its removal would probably occasion more damage to the tiles than simply leaving it alone. It is perhaps encouraging that the decay of tiles occasioned by this material appears to be confined to eighteenth-century and modern tiles, and the medieval tiles which it surrounds appear to remain in sound condition.

Cleaning tests were carried out using acetone, deionized water, and deionized water with a wetting agent. The work at Rochester had used water with a wetting agent, with some success; but at Winchester it was found that clean water served equally well, and avoided the introduction of any additive to the surface of the tiles. Trials were also carried out on the same basis on surface consolidants, and a solution of 10 per cent Paraloid B72 was found after analysis to be effective, and to permit the tiles to breathe.

With the completion of these small trials, a programme was established for the repair of the whole floor. The first stage of that programme was to be the treatment of a small but now significant area of tile as a continuing trial. The area selected for this was a strip of tile perhaps 1m wide, outside the Langton Chapel, in the southeast corner of the retrochoir. This area contained a variety of tiles, some pointed in the red mastic, some pointed in cement, some repointed in recent years and relaid following the introduction of ducting, and contained both rebedded medieval tiles, and later tiles. The area, therefore, gave a selection of the problems which would be later encountered over the whole of the floor.

Throughout the whole of the process of the formulation of the specification, and of the philosophy of the repair of the tiles, consultations were held with English Heritage and with the Cathedrals Fabric Commission for England; at several stages other bodies were drawn into the discussion, including the Society for the Protection of Ancient Buildings (SPAB). The consultation produced some change in the original philosophy, but surprisingly little variation in the approach to the repair.

The first policy for the repair produced several different aims and assumptions:

- The central vessel of the retrochoir should remain protected from traffic.
- Sound original tiles in the aisles, in areas which would be subject to wear, would therefore be taken up and rebedded as repairs in the central vessel.
- In general in the central vessel tiles would be left in situ as far as possible; where cracked or broken and capable of repair in situ then this would be the course followed. Only where the tiles had suffered such damage that repair could only be effected by taking them up, would this be undertaken; in that case the tiles would be lifted, the fragments reassembled with adhesive, and rebedded.
- Good tiles removed from the aisles to the central vessel would be replaced by replicas of the original work, glazed or unglazed.
- Repairs to cracked or broken tiles would be carried out by lime mortar repair, replicating in mortar the pattern of the background and inlay.
- Tiles would be grouted and pointed in lime mortar.
- Tiles would be cleaned before repair, and consolidated after repair using Paraloid B72 in a 10 per cent solution.

After discussion, it was felt inappropriate that any tiles should be removed from their present or original positions; even though in following this philosophy some tiles in situ, and which are good examples of their kind and now in sound condition, would remain subject to wear. One such area is that immediately to the south side of the Beaufort Chantry, where a small area of in situ tiles remain, and where many of the tiles are in any case of medieval origin. This area is subject to exceptional visitor pressure, because of the numbers who stand outside the Chantry to look at the effigy, and the interior of the Chantry. The modification meant that all tiles would remain in their present position. Only tiles severely worn, or cracked beyond repair – in other words entirely fragmented – would be replaced, but they would still be replaced with replicas. In certain areas at this stage it was felt desirable that quite large areas of tiles should be replaced by replicas; for example, to the east of the Beaufort Chantry a strip of tiling relaid in the 1970s over new electrical

ducts was felt to be one such candidate, because of its sheer ugliness. In another area, in the north aisle, a further area of modern tile was considered as a candidate for this approach, in an area where the earlier carpet pattern of the tiles could be restored because of the evidence of in situ tiles which remained on one side of the aisle.

Diana Hall was approached to research, and produce the replica tiles. An earlier attempt had been made to reproduce tiles in the north presbytery aisle, to the immediate northwest of the retrochoir, in 1969 by Professor Baker and Eve Baker. Although some research had been carried out at that time to reproduce the clay, the tiles produced in that repaving work were all slightly domed and by the time the work in the retrochoir was underway the wear on the surface of the presbytery aisle tiles was very severe. Over most of the area of that floor the original glaze had been worn off completely.

The Cathedral Curator, John Hardacre, was able to provide samples of tiles taken up from the presbytery aisle in that campaign of work for Diana Hall to analyse. By this method it was possible to reproduce the exact mix of clay of the original work, and a number of trial samples were produced. Their match of the original tiles was very successful. The first samples produced indeed a finish with a very dark glaze; and initial misgivings about the colour were overcome when, by a coincidence, a fragment of thirteenth-century tile was discovered in the core of the West Front, where stonework repair was in progress at the same time, and the glaze on that fragment matched exactly the colour of the tiles produced by Diana.

Perhaps unfortunately, it was felt that for purposes of repair – where new tiles were to be introduced in a background of existing earlier tiles from which the glaze had entirely worn – the dark glaze would provide too great a contrast; in the final batches for repair, the glaze was modified so that it would produce a lighter, redder colour.

Selected deeply worn tiles were replaced with the first sample replica tiles in the first stage repair area outside the Langton Chapel. The appearance of single replicas in a field of existing repaired tiles could then be assessed. This first stage area underwent the full range of treatment which had emerged from the consultation process – cleaning with deionized water and cotton wool; pecking out loose and cement joints but leaving the sound red mastic joints alone; cleaning out cement fill in broken tiles and grouting and repair in situ using coloured hydraulic lime mortar, repointing and grouting in hydraulic lime; and surface consolidation using a 10 per cent solution of Paraloid B72. Small areas of surface finish were also tried at this stage, including microcrystalline wax intended as a surface protection against wear of the Paraloid coating. With the completion of this stage of the work, further work

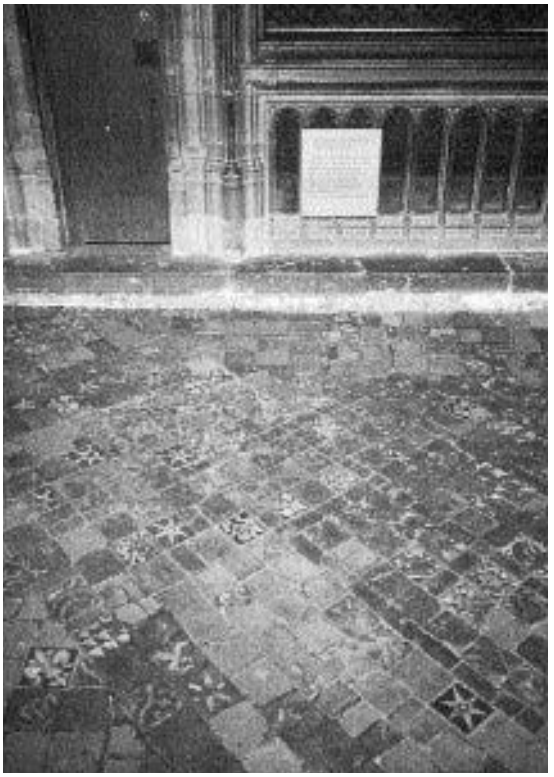

Figure 12.2 Conserved tiles, many of which are in situ, completed in the first stage of work. Isolated replica tiles are visible (Photograph, Peter Bird)

Figure 12.3 Contrasting areas of conserved tiles and replicas and tiles awaiting cleaning (Photograph, Peter Bird)

Figure 12.4 Completed mortar repairs and pointing conservation (Photograph, Cliveden Conservation Workshop Ltd)

was suspended for six months so that the results of the repair could be assessed (Figure 12.2).

It immediately became clear that the weak 10 per cent solution of Paraloid was vulnerable to attrition. Furthermore the tiles treated with microcrystalline wax showed evidence of a bloom developing between the wax and the Paraloid coating, possibly as a result of inherent damp drying through the surface of the tiles. It was decided at that stage to abandon the use of microcrystalline wax as a surface protection and to apply the Paraloid in two coats, first at a 10 per cent solution, and second at a 20 per cent solution. It was also felt desirable that further trials of different surface coatings would be tried as the work proceeded but the decision as to whether, and how, to provide surface protection would be deferred until the completion of the whole project.

The consequences of using fully glazed replica tiles was also reassessed at this period. The use of unglazed replicas was considered, on the basis that they would blend into the background more satisfactorily. However, especially following the results of trials which suggested that the new tiles unglazed had a greater surface porosity, and might therefore be more vulnerable to wear than their unglazed but aged neighbours, it was considered that glazed tiles should be used for repair despite the possible contrast with the surrounding work (Figure 12.3). This was felt philosophically to be more acceptable, since they would represent honest repair in material as near as possible to the original work, and that they should be allowed to wear naturally – adopting much the same philosophy as that being applied in the stonework repair in progress at the same time on the West Front.

With these early trials and decisions complete, it was possible to formulate a programme to proceed with the repair of the whole floor. The floor was divided into areas which would be worked on one at a time – this would mean that the retrochoir could remain open to the public, and that the public would also be able to see the work in progress. Funds also became available at this time to ensure that the whole project could be completed, as the result of success in 1995 in obtaining a European Union Grant for the work.[1] This complemented grants from the Monument Trust, and from English Heritage, which together have funded the whole project. The work progressed steadily through to completion in June 1996. Such was the skill of

[1] The project has won an accompanying Award for Conservation of the European Architectural Heritage.

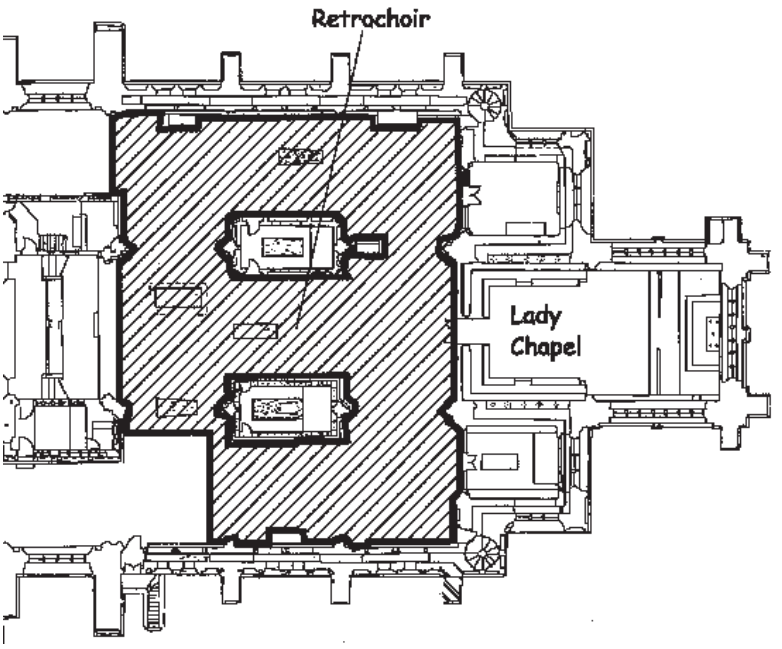

Figure 12.5 Detail of floor plan of retrochoir

Vanessa Simeoni, the lead conservator, and her colleagues in saving and repairing quite severely damaged tiles, that it proved necessary to use many fewer replicas in the repair than had originally been expected; in the central vessel, where most of the in situ tiles remain, no replicas were used at all, and the largest area of replicas, as had originally been hoped, was confined to the restoration of the carpet pattern in the north aisle (Figure 12.4).

The original proposals had included the maintenance of the barriers within the retrochoir, to keep the public out of the central vessel. As the work progressed, and as it became clear that the surface consolidation and repair of the tiles appeared to be very successful, this policy has been under review.

Part of the project included the removal of the effigy of Arnaud de Gaveston, which stood in the middle of the north aisle, in such a position that it created a funnel of traffic over a vulnerable corner of the tile pavement. The effigy had been moved to this position earlier this century from the North Transept; and now the tomb chest was moved once again, but only sideways to a new position against the north wall of the aisle, so that the 'narrows' it had created would be relieved and so reduce the concentration of wear at this particular point.

Extending this philosophy to the whole floor, it was considered that the creation of any narrows or funnels by the use of barriers for traffic could only exaggerate wear in those areas. It is not possible to exclude people from the retrochoir; this is a living building and continues to be used for the purpose for which it was built. We can only hope to mitigate the effects of that use. Barriers may only preserve parts of the floor at the expense of accelerated wear on other areas. During the course of the repair and conservation work, when barriers were removed and people were free to spread over the whole floor area, it did appear that dilution of traffic could help to minimize wear on the floor as a whole. This trial, of leaving the floor open, is now under way, and the results of this free access will need to be carefully reviewed from time to time so that a decision can be made as to

whether to barricade the retrochoir in future for the protection of the tiles. At the moment the glorious quality of the uncluttered space remains visible (Figure 12.5).

The project has been successful in restoring the colour and quality of the tiles, and clarifying the design of the in situ tiles where it survives. The surface consolidation of the tiles appears to have provided a good wearing surface as well as its primary purpose, and a maintenance regime is being established which will include regular careful cleaning, a programme of careful monitoring and repointing of joints, and resurfacing probably at biennial intervals. Trials into the provision of further surface coatings are under way; not only in the use of microcrystalline wax, which appears to be more successful in providing a surface finish without bloom after a suitable period to allow the conservation interventions to dry out; but also in proprietary finishes such as Aquatex, and in one small area on modern tiles a combination of Bourneseal and turpentine. As already noted, the approach to access is under active consideration and will be reassessed; the options lie between barricading certain areas and increasing the load on others, or leaving the space free to spread the load of tourists. The extent of carpet and matting to clean feet before they walk upon the tiles has also been increased, and matting barriers are now provided at each entrance to the retrochoir, as well as those which lie at each main entrance to the Cathedral.

The success of the project lies not only in the exciting restoration of the floor, and consequently of the space; but also in the recognition that successful conservation relies as much upon continuing maintenance and care as in the original more glamorous project itself.

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13

Use and abuse

Management and good practice in cathedrals and greater churches

Jane Fawcett

As so little thought has, until recently, been given to floor damage, many practices have arisen which can be avoided. One of the most fundamental difficulties when considering floor protection is the conflicting patterns of use. There are the liturgical requirements of the Dean and Chapter, essential in order to fulfil the primary role of the cathedral; secondly, the needs of the choir, including the provision of pianos, rehearsal and changing rooms; thirdly, the functions which form an integral part of the life of the cathedrals, including concerts, flower festivals, plays and television programmes. Then, there are the visitors, and the shops, signs, collecting boxes, information centres, restaurants, lavatories, brass rubbing centres and exhibitions which cathedrals and churches increasingly wish to provide, and from which they derive valuable income. Finally, there is the maintenance and cleaning of the building partly necessitated by these uses.

All of this has an impact on the historic fabric of the building, and more particularly on the floors. In order to minimize this, it is necessary to consider how and where damage is inflicted, by whom, and to what extent it can be controlled or modified. In many cases much of it could be avoided if greater care were taken and better instructions given to all personnel.

13.1 Worship, liturgical needs and functions

Nave altars are usually surrounded by stalls, chairs, candelabra, lecterns, carpets and flower stands. Care should be taken in placing such furnishings, in view of the damaging effect that they often have on historic floors. The siting of all furniture should be evaluated since increased use accelerates floor damage. There are a number of examples, including Winchester Cathedral (see Plate 28) and St George's Chapel, Windsor, where nave altars and associated furniture have been sited over important ledgers.

The placing of lecterns, carpets and other movable objects in chancels should also be considered in the context of the valuable floor surfaces which are usually found, particularly in such areas.

Pianos needed for choir practice and for concerts often have to be moved regularly over delicate surfaces. Music stands, if they are frequently moved, can also scratch floors. Pianos and stools hired for special concerts

and moved by outside contractors are a particular hazard. The placing of chairs on important brasses and ledgers should be reconsidered, and protective pads fitted to prevent scratching. At Westminster Abbey the chairs are placed on top of nineteenth-century brasses in the nave, which have become seriously worn. At St Albans Abbey chairs are placed over brasses in the chancel. Movable chairs are one of the most destructive furnishings in ecclesiastical buildings. The old fixed pews did far less damage.

Functions can be destructive, since they involve the frequent moving of heavy stands, seats, lights, platforms and other equipment, much of which is dragged from some distance and placed in position, often causing serious damage to floors. Great care must be taken in moving heavy objects, including scaffolding. Staff should be instructed wherever possible to lift all equipment rather than drag it. The use of sack trucks or trolleys with rubber wheels and of small electric fork-lift trucks with rubber wheels, to move stacking chairs and other smaller objects, would also help. Where heavy platforms require moving, staff should be provided with rollers to minimize scratching. The bases of stands and platforms should be padded, and all chairs fitted with protective pads.

Film and television crews need careful supervision to avoid causing unnecessary damage when fixing lights, cameras, platforms or scaffolding. It is important to have full and detailed contracts signed by both parties specifying precisely what may and may not be done, and the penalties that will be incurred in case of infringement. In all cases, without the most careful supervision ignorant operators can and do inflict serious damage, often unknowingly.

As all cathedrals are increasingly used for public functions, the dangers of adapting delicate medieval fabric, designed implicitly for the celebration of worship, for use as a public auditorium and concert hall become more serious. Floor protection is only one aspect of a grave threat to the character and integrity of these vulnerable buildings.

The wish of the Dean and Chapter to improve standards of comfort has been partially responsible for the installation of under-floor heating in the naves of Canterbury and Chester Cathedrals and Pershore Abbey recently. Others may follow. When dealing with floors largely undisturbed since the Middle Ages, the archaeological damage inflicted and the loss of ledger stones, medieval tiles and ancient paving is unacceptable (see Appendix). There are also attempts to create a centrally planned auditorium in a cathedral expressly designed with a stalled choir. Changes in ritual, liturgy and fashion have, over the years, destroyed many ancient furnishings and floors. But the present trend for greater public comfort and access is potentially just as damaging.

In 1993 the Building Research Establishment installed monitoring floor studs at pressure points in Westminster Abbey and St Paul's Cathedral to measure the rate of deterioration. The interim findings indicate that the average rate of surface wear in such heavily used areas is approximately 1 mm per decade. When considering floor memorials with delicate inscriptions or relief decoration, medieval tiles or brasses, this represents a very rapid rate of obliteration.

Ruskin, in *The Lamp of Memory*, refers to 'surfaces that have been worn half an inch down. The whole finish of the work was in the half inch that is gone'. Recording what remains is thus a race against time.

13.2 Management of visitors

More attention has been paid to providing facilities for visitors than to controlling the damage they inflict, largely by their feet. Many installations have been introduced without regard for the floor surfaces on which they have been placed, and lessons have been learnt too late, when damage has already been inflicted.

Shops should be sited, wherever possible, outside the main building, since they are

disruptive and increase the risk of damage. Shops which are now placed over important surfaces should be moved to less vulnerable areas. Damage has been caused to historic ledgers at Westminster Abbey as a result of installing the brass rubbing centre and shop in the north walk of the cloisters. Better locations have been sought outside the Abbey, but no alternative solution has materialized.

Many cathedrals now have a shop, a refectory, an exhibition and a treasury. All these facilities add immeasurably to the experience of the visitor and generate valuable income, but when lodged within the main body of the cathedral, represent an insidious increase in commercialism, and a threat to the fabric, and to the religious atmosphere. Unfortunately many chapters sold property in the Cathedral Close to raise funds, only to find that, with the expansion of tourism, such adjacent property was what they needed.

The new shop and restaurant at Winchester Cathedral have been sited in a new building to the southwest of the cathedral. At Norwich an interpretation centre will be housed in a new building, designed by Michael Hopkins, near the cloisters. Durham is planning to install more visitor facilities in the Close. At Canterbury William Whitfield has designed a new education centre for the Close. The shop at St Paul's Cathedral has joined the treasury and an exhibition in the crypt. By moving some of the larger statues, an opportunity for excellent design has been provided in this superb setting.

At St George's Chapel, Windsor, however, the shop in the Bray Chantry chapel, with its accretia of postcard stands, book cases and cash boxes has been visually unfortunate, and physically damaging. The floor, containing many historic ledgers was, before the installation of the shop, in excellent condition. A protective floor has now been laid, but not before considerable damage had occurred. The balance between providing for visitors and damaging the fabric is a delicate one.

Unless an entrance charge is levied, donations are important, but the siting of collecting boxes, to minimize damage, should be reviewed.

Although the intrusion of signs and regulations is regrettable, there is today a greater awareness of the need for a coherent house style, and for siting which is not unduly disruptive. Signs and instructions are necessary tools in the control of the public. Information panels should not, however, be placed over important floors, as they attract crowds and wear.

Many cathedrals now restrict the entry of dogs, and of children with chewing gum or ice-creams. None forbid shopping trolleys which damage both floor surfaces and delicate screens and piers. They have no place in religious buildings. Rucksacks should also be prohibited in small chapels containing important monuments. The provision of cloakrooms could prevent these intrusions.

Suitably placed mats at all external doors can remove up to 95 per cent of foot-borne dirt. Door mats must therefore be considered obligatory if the protection of floors is taken seriously. Surprisingly, very few cathedrals and churches have installed them. This needs urgent attention. The *Advisory Note on Good Practice for the Care of Ledger Stones and Other Floor Memorials in Cathedrals* issued by the Cathedrals Fabric Commission for England (1997) recommends a conservation plan, to balance the legitimate requirements for the use of the building with the preservation of floor memorials. This should cover management, maintenance and conservation, and be implemented by all cathedral personnel.

No cathedrals have controlled the entry of those wearing unsuitable footwear. The National Trust prohibits the entry of visitors wearing shoes with stiletto heels and offers slippers instead. Gibside Chapel, Northumberland, is a case in point. Much damage could be avoided if cathedrals did the same. Overshoes were supplied to protect the tiles in the Chapter House at Westminster Abbey. The coir perimeter matting, provided by English Heritage as a substitute has failed as

it stretched, was abrasive, and created dust (see Appendix p.219). Furthermore the microcrystalline wax applied to the tiles as a protective coat discoloured the tiles. Its recent removal with solvents may have damaged the tiles. Overshoes are once again being considered. The obligatory use of overshoes is common in many heavily visited European buildings, and it is also a means by which the number of visitors can be regulated.

The best way to see an important floor is not to stand on it, but to view it, preferably from above. This has been recommended for the medieval floor of the Martyrdom Chapel at Canterbury (see Appendix, p.207) and the principle should be applied to all exceptional floors. The medieval tile pavement recently restored in the Library at Lichfield Cathedral is being left uncovered and public access is being restricted to a viewing platform at the entrance.

Covering sensitive areas seems to be the only sensible way to protect them. However, many forms of protective covering do more harm than good. The attempt to protect individual brasses by covering them has frequently inflicted greater damage than the impact of the feet which they were attempting to exclude, owing to the abrasive effect of grit beneath the mats. At Westminster Abbey the brass to Bishop Monk in the north choir aisle has been seriously corroded by efforts to protect it with a sheet of lead. An electrochemical reaction was set up, rising damp was trapped under the lead, and a process of bimetallic corrosion developed, causing the brass to break up. At Lincoln Cathedral an important brass was also damaged by a lead protective covering, since removed. Many brasses have been covered with mats, often placed over a rubberized underlay, which traps rising damp. Invariably mats collect dust and grit, and unless fixed in position, scratching occurs.

Moving important brasses to protected positions is one answer. The other is to cover them with a large mat with a thick felt underlay, regularly cleaned. It is also essential to carry out frequent inspection to ensure that brasses are not loose, or in danger of breaking up. Occasional cleaning with white spirit or a paraffin-soaked rag is recommended, but never with metal polish, which contains abrasives and ammonia, both damaging to the surface (William Lack, the well-known monumental brass conservator).

The Great Pavement at Westminster Abbey (see p.60) has for many years been covered by a floral carpet with a rubberized underlay. This has caused more damage than would have been inflicted by the feet of the clergy. This pavement, one of the glories of the Abbey, was designed to complement the high altar. There is a strong case for leaving it uncovered, since there is no public access. Following the archaeological survey, carried out in 1996, there is a strong possibility that it will now be conserved, and left uncovered (see Chapter 3).

Protective wooden floors are probably the only satisfactory method of conserving floors of such fragility and importance. The disadvantage is that the public are deprived of one of the major experiences that the buildings have to offer. Our responsibilities as conservators must outweigh the demands of tourism, and when a whole tiled pavement is at risk, as at Winchester, Westminster, Lichfield, Canterbury, Gloucester and Salisbury Cathedrals (see Plate 29), only the exclusion of the public from the whole area can provide a solution. So few medieval tiles remain that they cannot be regarded as expendable.

The simplest and cheapest method of control is to rope off fragile areas. Many brasses are protected in this way. There is, however, a danger that by protecting one important feature, the damage may be deflected to another. The damage inflicted on the pavements in Canterbury's Trinity Chapel and Corona Chapel, including the *opus Alexandrinum* pavement and the pink marble pavement laid to frame the shrine of St Thomas Becket in the Trinity Chapel, led to their being roped off, but the medieval tiled floor in the Corona Chapel is still unprotected, as are many medieval tiles elsewhere. Although the retrochoir at Winchester has

undergone a sensitive restoration, the public are once again allowed to walk on the tiles. Stiletto heels and shopping trolleys have been observed since the repairs were completed.

13.3 Conclusions and recommendations

The first requirement in protecting historic floors is one of recognition; this has, until now, been almost entirely missing. The second, is to identify areas of particular importance, and the third to devise ways of controlling the overuse which is causing the damage. Much overcrowding could be avoided by introducing rigorous booking systems for coach parties. Too many people in confined spaces destroys the experience for others, quite apart from the damage it causes. It should be recognized that large crowds and small chapels are incompatible, and that access to confined spaces should be firmly controlled.

Much damage could be avoided at Westminster Abbey if entry to some of the Royal Chapels were restricted. Access to the shrine area has recently been stopped, to prevent further damage, and the Cosmati pavement uncovered (see Chapter 3). At Canterbury several chapels have been closed for protection. Unfortunately, the most delicate and beautiful decorated floors are to be found in choir aisles, chancels and chapels, and these are particularly vulnerable. In many houses open to the public, small rooms are roped off for protection. The same treatment should be applied in ecclesiastical buildings.

In developing suitable routes for visitors, floor damage is seldom considered. At Lincoln Cathedral the spread of massive medieval indents in the north and south choir aisles are directly on the tourist route, and have no protection (see Appendix, p.212). The floors in the north and south choir aisles at Exeter and Ely Cathedrals contain a vulnerable mixture of medieval ledger stones and brasses.

Another requirement in the struggle to conserve floors, is to keep them clean. Crowds create dirt, and dirt destroys. Heavy industrial cleaning equipment, often used in cathedrals and churches, can seriously damage floors and monuments. Only domestic-sized vacuum cleaners should be used to remove dust and grit. Strong abrasives, detergents, bleaches and polishes should be avoided. If absolutely necessary, a little water is preferable to the use of any cleaning agents. Water-based varnish, as has been applied to the encaustic tiles at Tewkesbury Abbey and to the ledgers in Kilkenny Cathedral, Ireland, and microcrystalline wax, as used in the chapter house at Westminster Abbey, should be avoided.

The second requirement is to control unsuitable behaviour and noise; to prevent unsupervised groups of school children from running, sliding and shouting; to prohibit the wearing of unsuitable shoes; and to control the entry of visitors carrying unwieldy baggage or pushing trolleys. Such practices would not be permitted in historic houses open to the public, and should be rigorously monitored in cathedrals, as they adversely affect visitors' perception of ecclesiastical buildings as places apart. Silence has become such a rare commodity, cathedrals should cherish it; it encourages respect, seemly behaviour and worship.

Above all, since floors were made to walk on and deterioration is inevitable, it is our duty to record all the elements that make up a historic floor, so that important evidence is not irrevocably lost, and conservation, repair and even replacement become possible. It is also important that, wherever practicable, wear and tear should be minimized. Recording is of particular importance in the case of ledger stones, where the inscription is the principal interest. As this is only surface deep, it is easily obliterated. When ledgers are of exceptional quality, owing to their age, materials, or associations, special protection is required. Otherwise wear has to be accepted, but recording, and occasional recutting can minimize the loss.

The repairs to the chapter house floor at Westminster Abbey by Gilbert Scott in the

1860s, when replica tiles were introduced, were reasonably well documented. The same is true of the Cosmati pavement at Westminster Abbey, repaired in the seventeenth century, and again by Gilbert Scott in the nineteenth century. A further programme of conservation is under discussion now. The *opus Alexandrinum* pavement at Canterbury Cathedral was also heavily restored in the nineteenth century, and reasonable records exist. So long as these conservation programmes are fully recorded, and carried out in a scholarly manner, there can be no criticism. The outstandingly important factor is recording, in order to establish what is there, before it is taken apart and evidence destroyed.

Regular recording at all levels, archaeological, historical, physical and environmental is increasingly recognized as playing a key role in the continuing life of the great buildings of the world. This must be the single most important message, if our outstanding historic floors are to survive.

13.4 Experience from other countries

The restoration of some of the most famous floors in Europe has continued throughout their history. Unfortunately, many of these repairs were inadequately documented.

Many of the great mosaic pavements in Italy were moved into museums in the nineteenth century.

Many French medieval tiled floors were replaced by Viollet-le-Duc. At Sainte Chapelle in Paris some of the important medieval tiles were replaced with encaustic replicas in the nineteenth century.

The ecclesiastical floors of many European countries have problems similar to ours, one of escalating damage caused by intensification of use. There are, however, few recognized methods of protection, little accepted policy and no concerted action.

The situation is critical, few have addressed it seriously, such solutions as have been adopted are at best random, and there is little co-ordination. The range of decorative floors is enormous and includes many regional variations. An international survey is urgently needed to investigate the extent of the problem, to assess the effect of present practices, and to collate conservation methods and techniques. Above all, recording needs to be encouraged internationally before any more historical evidence is destroyed.

13.4.1 Italy

Italy has some of the richest mosaic floors in the world. One of the most notable, and one most seriously threatened, is that of the Basilica of San Marco in Venice. Virtually the complete floor surface is covered in mosaics dating from the ninth to the eleventh centuries. Many have been restored. The great eleventh-century mosaics in the narthex were relaid in concrete in the 1950s. They are incredibly rich and, owing to subsidence, undulate in remarkable waves, much admired by Ruskin. Some are figurative, others geometric. They are being damaged both by feet and by sea water penetration. The flooding of the Piazza penetrates into the narthex, flooding the floor to a depth of 1 m. This occurs about forty times each year. The damage inflicted both by the deposition of salts and by the scourging of sea water affects not only the mosaics on the floors and walls, but also the foundations. Solutions are being sought and the installation of a combination of valves and pressure pumps to stop the water sluicing in from the lagoon is being considered by the City Council's engineers.

The nave now suffers from unsightly matting extending in front of the high altar. This appears to offer little protection to the mosaics underneath, since it is loosely woven, frequently wet, and allows the passage of grit, which grinds into the mosaics below.

The magnificent Basilica of Aquileia, near Venice, has the rare distinction of an almost perfectly preserved early Christian fourth-century mosaic pavement (see Chapter 1). This floor underwent a sensitive in situ restoration

in 1983 under a UNESCO/ICCROM programme. Visitors are now required to walk on duck boards or matting, and to look down on the floor, rather than walking on it.

Siena Cathedral contains the most famous Renaissance pavement in Italy. It is composed of fifty-six designs in marble inlay, with designs by over forty artists, including Pinturiccio and Beccafumi. The roundels, containing biblical scenes, alternate with geometric borders of great subtlety. Leopoldo Maccari restored several of them in 1864–5. Attempts to protect them have included some areas being roped off, thus increasing the wear on others, and sometimes, as at present, the whole floor being covered with a protective wooden structure. This avoids the dangers of rising damp and condensation, but denies the public the visual experience. Dr Jokilehto of ICCROM, Rome, reports that the feasibility of covering the entire floor with transparent protective panels is being considered, but no suitable material has been found. In Munich a transparent material known as Lexan has been tried. If such a material proved to be effective, many of our problems would be solved. As the pavement is one of the main glories of the Cathedral, it is self defeating to conceal it, but irresponsible to destroy it through overuse. The usual dilemma.

In Rome, the Cosmati pavements have undergone various repairs. Santa Sabina was restored by Fontana in 1586–1587 and Antonio Muñoz undertook excavations and repairs between 1914 and 1919 which revealed a Cosmatesque pavement in the aisles. The pavement in Santa Saba was relaid in 1900–1901, during excavations, and again conserved in 1931 (Glass, 1980). The enormous church of Santa Maria Maggiore has had the floors extensively conserved, funded by a recent grant from the Getty Foundation. The cathedral of Anagni is the recipient of an EC grant to fund the current restoration of the pavements in the main church (restored extensively in 1880) and in the crypt (largely unrestored) and of the superb wall paintings commemorating Thomas Becket (see Chapter 1).

13.4.2 Germany

The ledger stones which pave many of the cathedrals frequently contain a life-size effigy in relief. These are most impressive, and need protection. Cologne Cathedral is paved throughout with a remarkable mosaic floor designed by Auguste Essenwein from 1885 (see Plates 12–14 and Figure 1.10). The mosaics represent biblical scenes, and, round the chevet, portraits of the Archbishops of Cologne. There are also large areas paved with geometric designs in marble, including a fictive cube design behind the high altar, similar to Seville Cathedral. A labyrinth pavement was designed and laid by the steps to the crypt in 1977 by Dr Arnold Wolff, architect to the cathedral. Dr Wolff has been investigating a suitable transparent protective material for the mosaics.

Professor Petzet, General Conservator of the Bavarian Ancient Monuments Department, reports that many historic floors in German cathedrals and churches were destroyed, from the 1950s until the early 1980s, by the installation of heating. There was also anxiety that uneven surfaces could be a danger to the public. This destruction was carried out against the advice of the official conservation organization, the Denkmalpflege. There is now a greater awareness of the importance of recording and protection, and a realization that historic floors form an integral part of the monument to be conserved. However, no general recommendations for their treatment exist and there is no inventory of ecclesiastical floors in Germany. The few publications are largely concerned with repair techniques. Rolf Wihr's book on floors, published in Munich in 1985, contains valuable technical information. Marquetry floors have been expertly restored, after war-time damage, in many historic buildings (see Chapter 14).

13.4.3 The Netherlands

The former Cathedral of Utrecht contains many fine ledgers, all unprotected. Dr Arie de Groot, an authority on the building, states that 'in the

Netherlands most old church floors for the greater part consist of ledger stones, many with inscriptions and sculptures. It is nearly impossible to find an acceptable solution that does not destroy the historical character. In Utrecht only the small Emperor stones, small lozenge-shaped inscribed stones dating from the fifteenth century, in the high choir, are protected by railings. The fourteenth-century floor tiles found in the cathedral during the restorations of 1922 and 1924 are now in the Central Museum. In a few other churches there are floor carpets or perspex plates to prevent damage'.

Utrecht was an important centre for tile making in the thirteenth and fourteenth centuries. Some of these tiles, and tile makers, found their way to Britain. The geometric medieval tiled floors in Deventer Church are not unlike those at Byland Abbey. There are still about fifty medieval tiled floors surviving in and around Utrecht, both in churches and in medieval houses. This will be the subject of an exhibition in Utrecht. Many of the tile patterns have been preserved.

After 1869 there were no further burials in churches in the Netherlands, and only members of the Royal family are entitled to church burial today.

The official government agency, the Rijksdienst voor de Monumentenzorg, has now developed a policy for the repair of historic church floors, and recognizes their importance as a source of information on iconography, genealogy and heraldry. They recommend that, after recording and documentation, care should be taken to spread the pressure points from scaffolding to avoid localized damage; plumbing and wiring should be supervised to prevent damage to graves and grave slabs; public access should be controlled to avoid wear on valuable surfaces. All work now requires a licence under the Historic Monuments Act.

13.4.4 Austria and Switzerland

The historic floors of the cathedrals and abbeys of Austria are justly famous. Innsbruck Cathedral has important marble floors, and the abbeys of Melk and St Florian contain superb marquetry and marble floors, some of them protected by the use of slippers. The Abbey of St Gallen in Switzerland has, in the library, fine marquetry floors, also protected by slippers.

However, Dr Koller, Head of the Government Ancient Monuments Conservation Department in Austria, reports that, while in some areas repairs are being carried out to different floor types, there is no co-ordination and no overall exchange of information on techniques used. There are fifty volumes of the *Österreichische Kunsttopographïe* prepared by the Bundesdenkmalamt, the official agency and published by Schroll, which contain useful material on historic floors.

13.4.5 France

The great labyrinth pavements in Chartres, Amiens and Reims Cathedrals have been referred to in Chapter 1.

Many historic floors were replaced, in the nineteenth century, by Viollet-le-Duc, often with encaustic tiles, which are themselves historic. However, there are still many outstanding medieval stone floors, tiles and ledgers remaining. At Tournus Abbey, Provence, some early ledgers have been taken up and stacked against walls at the west end. Many historic church floors are in an appalling condition.

There are many French publications on medieval stone and ceramic floors and on the conservation of mosaics, but the problems remain similar to ours, and the solutions equally difficult.

13.4.6 Kilkenny Cathedral, Ireland

St Canice's Cathedral, dating from c.1251, contains the most important collection of medieval tombs, effigies and grave slabs in Ireland. The dates range from the thirteenth century to the late sixteenth century. The earliest slab, of 1280, is to Jose de Kyteler, with

an inscription in Norman French. The ledgers are of exceptional interest owing to their remarkable condition, the variety of lettering and decoration, many with black letter marginal inscriptions. Several are to sixteenth-century craftsmen with the medieval tools of the trade, including adzes, an auger and a carpenter's square; a weaver's fly, shuttle, loom and a spool of yarn; and a shoemaker's knives, an awl and slicker, and the sole and upper part of an Irish brogue. Some ledgers combine a foliate cross with the instruments of the Passion, with the sun and moon above.

Much of the floor surface is covered in these remarkable ledgers. Unfortunately the floor memorials are regularly treated with water-based varnish, which improves their appearance, but may lead to rising damp and deterioration. A sealer is first applied, followed by Lever Brothers industrial Vision 25 polish, with a maintenance coat on top. This lasts for one year. A special remover is applied before repolishing. Kilkenny Cathedral had 50 000 visitors in 1996.

13.4.7 Malta

The floor of the cathedral of St John in Valetta, is entirely paved with 175 coloured marble ledger stones (see Figure 1.31 on p.30 and Plates 16 and 30), some in high relief, with coats of arms, inscriptions, trophies and figures. The oldest ledgers date back to the early seventeenth century; many of them represent the Knights of St John or the Grand Masters. Although there is little documentation, it is thought that some ledgers were designed by a local artist, Romano Carapecchia d.1738, and all were made by local craftsmen. There is considerable local concern about the deterioration of these remarkable pavements which, owing to the high relief of much of the decoration, are susceptible to damage by stiletto heels. It was reported that after concerts held in the cathedral, marble fragments chipped from the ledgers by stiletto heels had to be swept up. A proposal to seal the entire floor with a form of perspex was rejected owing to the dangers of rising damp. Restoration work to the cathedral won a Europa Nostra award in 1994 and further restoration of the interior is underway.

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14

Secular buildings

Tile, mosaic and marble pavements, parquetry floors and carpets

Jane Fawcett

14.1 Floor tiles

The history of ceramic floors can be traced back to the ancient Egyptians, who, as early as the twelfth century BC, covered their brick floors with stucco, on which designs were painted. Ceramic turquoise blue tiles were produced in Egypt in the fourth millennium BC and decorated with lines scratched in the clay before glazing. Coloured and glazed relief tiles were made by the Assyrians and Babylonians in Mesopotamia between the thirteenth and fifth centuries BC, and in the fifth century BC in Persia, to decorate the palaces of the Achemid Kings.

The Islamic tile tradition, dating back to Mohammed, spread to Syria, Palestine, Mesopotamia, Persia, Egypt and North Africa as a major decorative element, and reached Spain in 711 AD. Persia was the centre from which the techniques used for Islamic tile production spread all over Europe. Lustre painted tiles, and relief decorated tiles, were used together to create decorative schemes. Tile mosaic, composed of geometric designs cut from glazed slabs, was developed by the Seljuks in Konya, central Turkey (Herbert and Huggins, 1995).

Owing to the lack of marble and coloured stones in north Europe, inlaid ceramic floor tiles were developed in northern France in the mid-thirteenth century, and their use spread to Britain and the Low Countries. The earliest inlaid tiles were made from limestone, found in Marquise, near St Omer. The white limestone was cut into tiles, polished, the design drawn, the background cut away and filled with coloured mastic. This technique, known as *champlevé*, was later adapted to clay tiles, stamped while still wet with a wooden stamp, the decoration filled with white clay, dried, glazed and fired. The glaze contained lead which brought out the colours. The burning in of the coloured clay inlays created the term encaustic (Herbert and Huggins, 1995).

The designs used for medieval tiles included heraldic animals, foliage, and geometrical forms, huntsmen with stags and hounds, and knights on horseback. Although a few medieval domestic pavements have survived, mostly in museums, tiles were used to pave many larger buildings, from the fourteenth to the mid-sixteenth centuries. The tiles were square and placed in groups of four, nine or sixteen, with plain tiles in between.

The first tile patron in Britain was King Henry III who set up a royal tilery at Westminster, from which floor tiles were made for Westminster Palace in 1237 (see Chapter 1). For St Stephen's Chapel and the Queen's Chapel marble altar steps were ordered, but 'if that marble should not be sufficient for both works, then to cause those steps (of the Queen's Chapel) to be made of painted tile'. In 1241 Henry ordered 'the whole of our hall at Winchester Castle to be paved, with decorated tiles on the upper step'. He went on to pave the 'King's chamber and the Queen's Chamber, and the Chamber of Edward, the King's son, with flat tile' in 1252. At the same time the floors of Clarendon Palace, the King's favourite residence were paved with 'a pavement of tiles in the King's Demesne chapel and in that of the oriel', and the King's and Queen's rooms. One of the chapels was paved with a circular design, similar to the Muchelney Abbey pavement (Wood, 1965).

Part of the Queen's Chamber was excavated in 1935 and the tiled floor, which pre-dated the Westminster Abbey chapter house, was found in situ, and moved to the British Museum. The Clarendon tiles, which were red, green, yellow and brown, were arranged in panels, containing heraldic lions and griffins, with a geometric design of lattice work with foliated crosses. The tiles came from the Wessex School and resembled those in Winchester Cathedral (Eames, 1992).

In 1365 Henry Yevele supplied '8000 tiles of Flanders for the paving of floors and other work' in the Palace of Westminster (Salzman, 1952). Two-thousand painted tiles were used to pave Richard II's bathroom in 1385 at Sheen. The survival rate for ecclesiastical tiles has been higher than for domestic, although two early fourteenth-century tiled pavements were found recently, in situ, at Clifton House, King's Lynn.

Flemish tiles were imported into Britain for secular buildings by the later fourteenth century. These included plain tiles (green and yellow) which were imported in their thousands. By the sixteenth century tile workshops were established in Rouen and Lyons, and in Antwerp and Bruges. Inlaid Flemish tiles from Antwerp were brought to Britain by Lord Sandys for the Chapel at The Vyne, Hampshire, c.1520 (see Plate 31). He acquired these in Boulogne, when he was Treasurer of Calais. Cardinal Wolsey, a leading patron, while Abbot of St Albans (1520–1530), tiled the floor of the hall at The More, Rickmansworth with Flemish tiles (Wood, 1965). For Hampton Court, in 1535 'Flemyshe paving tyll of greene and jowllo' (yellow) were bought, at 5s the 1000 (Salzman, 1952).

Christopher Norton has established the existence of a flourishing trade in the import of plain earthenware tiles covered in yellow and green-black glaze to sites all over England and Scotland, particularly along the east coast. These came from the Low Countries from the late fourteenth century to the sixteenth century, and were used in both ecclesiastical and secular buildings.

In Scotland, Linlithgow Palace had, in the presence chamber, an ornamental floor of stone and green tiles in a chequered design. There is a replica floor there today. Some of the tiles were inlaid with the initials of James IV and his wife Margaret Tudor, and dated between 1503, the date of their marriage, and 1513 when James died. These may have been produced locally (Norton, 1994). There was a revival of interest in patterned tiles during the sixteenth century, often decorated with the arms or heraldry of the owners. This was evident both in England and in Scotland, and more or less coincided with the decline in the production of ecclesiastical tiles. One of the last dated uses of inlaid tiles in secular buildings in England were those made for Sir William Sharington in 1550 for his reconstructed Lacock Abbey.

In Scotland, decorated relief tiles have been found in Dirleton (see Figure 14.1), Tantallon and Niddry Castles. These tiles, which are closely linked with Mary Queen of Scots through their owners, the Lords Ruthven and Seton, represent court taste of the 1550s. They

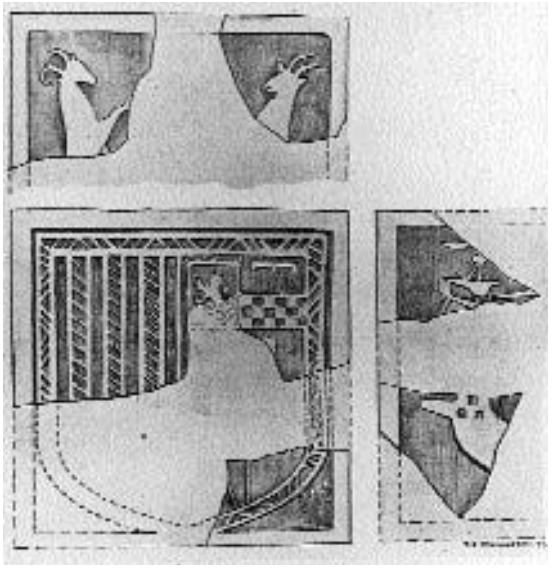


Figure 14.1 Dirleton Castle, Lothian, Scotland. Floor tiles, 1566–1584, showing Ruthven arms, reconstructed by James Richardson, 1928–1929 (Photograph, Crown Copyright. Reproduced by courtesy of Historic Scotland)

are contemporary with the three splendid tile pavements at the Château of Chenonceaux (see Plates 32 and 33) and those in the Château of Blois, owned by Mary Queen of Scot's father-in-law, Henry II, who died in 1559 (Norton, 1994).

During the Renaissance brick and earthenware tiles were widely used in Italy. Terracotta tiles were used in various shapes and patterns, including the herringbone design, where they were set on edge. This was later adapted to parquetry.

Polished brick floors were laid by Pope Pius II in his new mansion in Pienza in the 1460s and were, writes Peter Thornton (Thornton, 1991), 'without any uneveness whatsoever'. The Villa Lante at Bagnaia contains a brick tiled floor with the owner's coat of arms. Two-tone terracotta tiles, arranged in geometric designs, were used to pave floors from the fifteenth century until the late eighteenth century. A fine example exists in the mid-sixteenth century Palazzo Farnese at Caprarola where black marble sections were inserted to give contrast. The main staircase in the Palazzo Farnese in Rome by Sangallo, 1517, and Michelangelo, 1546, is paved with contrasted, geometric terracotta tiles. The Aldobrandini, Torlonia, Spada, Sacchetto and Massimo Palaces in Rome are also floored with two-toned terracotta pavements.

From the seventeenth century all-over designs, imitating marble or carpets, were produced in Southern Italy. A flourishing tradition of these hand-made tiles centred on Naples. Owing to the expense of individually designed pavements, the use of these tiles was confined to aristocratic patrons, and to churches. The designs often incorporated the family coat of arms, running across several tiles. There is a fine example in the Palazzo of the Prince of Sangro in Naples, of 1710 (Donato). Majolica floor tiles were made in Naples in the fifteenth century and also in Florence, where polychrome glazed terracotta floor tiles were also made in the Della Robbia workshops.

The fashion for Flemish or Dutch tiles, based on Antwerp, Bruges and Delft, led to the import of Dutch tiles to Britain, mostly for fireplaces, during the sixteenth and seventeenth centuries, with a revival in the nineteenth century. Dutch potters moved to England in the seventeenth century, and English Delftware was made in tile workshops in Liverpool and Bristol. The interest in Dutch tiles was promoted by William and Mary, who were familiar with Delft tiles in Holland. They appointed Daniel Marot to decorate the Queen's Dairy at Hampton Court with tiles from Delft. This led to the fashion for tiled dairies, which continued throughout the eighteenth and nineteenth centuries. The dairies at Althorp, Northamptonshire, built in 1786, and at Endsleigh, Devon, built in 1815 for the Duke of Bedford, were decorated with Wedgwood tiles, while Mintons tiled Prince Albert's Royal Dairy at Windsor in 1858.

Dutch tiles were not confined to Britain. In France, the Chateau of Beauregard on the Loire has, on the floor of the portrait gallery, 6000 Delft tiles, laid in 1646. In Germany, the

whole of the ground floor of the Nymphenburg Palace, near Munich, was paved with Dutch tiles in 1716–1719 (Gilbert *et al*., 1987).

The rediscovery of a native British tradition of medieval ceramic tiles took place during excavations of the nineteenth century. It was said that 'an art lost to us for 500 years is being relearned and restored to practical utility. Under the very feet of our ancestors, unheeded for centuries, lay the patterns from which our most modern ceramic floors are really derived' (Furnival, 1904).

In his *Encyclopaedia of Cottage, Farm and Villa Architecture and Furniture* of 1833 J.C. Loudon included thirteen designs for pavements in different coloured bricks, suitable for the hall and passages. Herbert Minton's first catalogue of 1835 showed designs based on medieval examples. He received many of his earlier designs, however, from Augustus Welby Pugin (see Chapter 1) who, in 1837, was commissioned at the age of twenty-four, to redesign a house, in the Gothic style, for Charles Scarisbrick, a rich Lancashire landowner (see Plate 34). Between 1837 and 1845 the house was remodelled, and Minton's tiles were used to pave the great hall and the main corridor. Pugin also produced floor tile designs, decorated with the Talbot crest, for the remodelling of Alton Towers, commissioned by the Earl of Shrewsbury, one of Pugin's leading patrons.

Their next collaboration concerned the Palace of Westminster, between 1847 and 1852 (see Chapter 18). Pugin wrote to Herbert Minton enclosing sketches: 'I am now making out the drawings for an immense quantity of tile floors for the Palace of Westminster asking that you will submit an estimate. If these are carried out they will be a grand work for you, for never was tiling used on such a scale'. Pugin said in 1852 'they are the best tiles in the world, and I think my patterns and your workmanship go ahead of anything' (Ferrey, 1861).

Sir Charles Barry installed Minton pavements at Trentham Hall, Staffordshire and at Cliveden House, Buckinghamshire, both rebuilt for the 2nd Duke of Sutherland. Neither has survived. The pavement at Cliveden had a border of white cherubs, with Corinthian columns supporting allegorical figures and a head of Medusa in the centre. Barry's Neo-classical Reform Club, London, of 1840 contains in the saloon a tiled floor with designs based on Etruscan vase motifs with a key fret border. In the four corners are the initials of Charles Barry and his craftsmen.

Prince Albert's interest in floor tiles was aroused at a meeting of the British Association in 1843, at which Minton exhibited his new process. This led to Minton's commission to tile the main corridors at Osborne House in 1845 (see Plates 35 and 36). Sir Matthew Digby Wyatt, who had a business association with Minton, designed the floor tiles, probably with advice from Prince Albert. The tiled floors blended with the pastel coloured plasterwork and fabrics.

Mintons provided a remarkable array of tiles for Prince Albert's Royal Dairy of 1858 at Frogmore, Windsor, designed by John Thomas. The floors, walls, columns, and friezes are all spectacularly tiled, using Mintons new majolica glaze. The attractive floor tiles have a non-slip surface. Mintons were subsequently commissioned to supply floor tiles for both Windsor Castle and Sandringham in the 1880s.

The growth of interest in encaustic tiles grew rapidly during the 1840s, fuelled by Royal patronage, and in 1847 the Society of Arts drew attention, in an exhibition of 'Mosaics, Encaustics and other Tiles, to a mode of decoration which all ages and countries have employed, and which has only fallen into neglect within the last two centuries' (Jones, 1993).

Owen Jones (1809–1874) was a prime mover in the development of tile design. His *Designs for Mosaic Pavements*, published in 1842 and *Encaustic Pavements* (1843) had a considerable influence, and illustrated ancient tiles. These were followed by his famous *Grammar of Ornament* published in 1856 (see

Figure 14.2 The Foreign Office, London, 1861. Sir George Gilbert Scott. Grand Staircase in 1896 (Photograph, Bedford Lemere. National Monuments Record)

Figure 14.3 The Foreign Office, London, 1861. Sir George Gilbert Scott. Grand Staircase. Detail of encaustic tile floor panel in staircase hall. Minton (Photograph, National Monuments Record)

Plates 38, 39 and 40). This drew its inspiration from a wide range of design sources, including Moorish and Pompeian examples. Sir Matthew Digby Wyatt, with Owen Jones, supervised the fine arts section of the Great Exhibition in 1851, and designed the Minton tiled pavement of the Pompeian House. Both worked for Herbert Minton.

Digby Wyatt collaborated with Gilbert Scott over the designs for the encaustic tiles in the Foreign Office (see Figures 14.2, 14.3 and Plate 41) and the India Office. Wyatt also developed an interest in Moorish tiles and his Moorish majolica tiles were displayed in the Great Exhibition of 1862. He also advised Henry Cole on the tiles used extensively at the South Kensington Museum (the Victoria and Albert Museum). The tiles in the Central Refreshment Room, 1868–1870, were by Maws, those on the remarkable ceramic staircase were by Minton, designed by F.W. Moody. Each riser of the staircase is tiled. The whole is a triumph in ceramics.

The Maw brothers, who eventually established their factory at Broseley, in the Ironbridge Gorge, became interested in medieval tiles found in a local church, and decided to copy them. A clay tile was made, and while still moist, impressed with a design in white pipe clay, which, when fired, showed some resemblance to the medieval tile, although the pipe clay had shrunk away from the background, and pieces had fallen out. The differential shrinking of the infill and the difficulty of obtaining an even surface took some time to resolve. The making, decorating and firing of tiles often took place in different but adjacent buildings within one factory. The input of raw materials, and the output of the finished product, were closely co-ordinated.

Figure 14.4 Wimpole Hall, Cambridgeshire, c.1793, Soane, and c.1840, Kendall. Encaustic tiled pavement. Entrance hall, c.1840. Kendall (Photograph, Jane Fawcett)

George and Arthur Maw were not only pioneers in the successful manufacture of encaustic tiles, but also pioneered the study of medieval prototypes, both in England and abroad. George Maw was an avid traveller, and a keen botanist. He drew medieval floors in Italy, and flowers found on an expedition to the High Atlas Mountains in Morocco with Sir Joseph Hooker. He was an authority on crocuses, many of which he grew in his garden at Benthall, Salop, now owned by the National Trust. Arthur Maw developed the techniques of production, took out twenty patents for the company, and wrote an authoritative account of tile making for the *Encyclopaedia Britannica*. By 1870 Maws had become the largest tile manufacturer in the world (Herbert and Huggins, 1995).

Encaustic tile making in France centred, in 1848, near Beauvais, where a firm was established by Jean-Baptiste Boulenger. Boulengers made encaustic tiles for Viollet-le-Duc, the French Gothic Revival architect.

An interest in Moorish tiles was aroused by volumes of colour lithographs, *Encyclopaedie des Arts Decoratifs de l'Orient*, published in France between 1871 and 1883. These also had repercussions in Italy.

The fashion for tiled entrance halls grew rapidly during the mid-nineteenth century, and many leading country house architects employed Mintons or Maws. At Wimpole Hall, Cambridgeshire, H.E. Kendall remodelled the seventeenth-century entrance hall for the 4th Earl of Hardwicke, in the 1840s. The encaustic tiled floor incorporates the Hardwicke motto and monogram and the welcome, *Salve* (Figure 14.4). A key fret border completes the scheme. The entrance hall at Somerleyton Hall, Suffolk, designed by John Thomas for Sir Morgan Peto, the contractor in 1844–1851, was also tiled. Even more exotic, grandiose, and out of its period, was the 3rd Marquis of Bute's Cardiff Castle, remodelled by the neo-medievalist William Burges from 1865. Tiles were used in many of the rooms. In the summer smoking room, a map of the ancient world is surrounded by circles of ships and whales on the floor. The walls are decorated with painted tile patterns, and with the signs of the zodiac.

Gilbert Scott decorated the floors of many of his buildings with encaustic tiles; they became a key note of his work. After Kelham Hall, Nottinghamshire, was destroyed by fire Scott's instructions were to build a fire-proof house. Encaustic pavements fitted excellently into this requirement and Scott paved the corridors, the carriage court, and the north staircase pavement with Minton tiles in 1857. Some of his designs show a distinct resemblance to the Great Pavement at Westminster Abbey, which he restored in 1863–69 (see Chapter 1).

Tiles also provided a cheap and colourful flooring for many public buildings. Scott's lavish pavements for the Foreign Office and India Office add an important dimension to the interiors. The staircase hall for the opulent Ambassador's Staircase, for which Clayton and Bell supplied the mural decoration, is paved with mosaic tiles in a plaited design with a central roundel, inscribed with Queen Victoria's coat of arms (see Figures 14.2 and

14.3). Many of the corridors are paved with geometric tiles.

Scott also designed tiled pavements for the Midland Grand Hotel at St Pancras. In the reception lobby he used an elaborate mixture of encaustic and geometric tiles, connected with mosaic bands. A similar mixture, although less elaborate, is found in the corridors. The paved floors were designed to complement the mosaic panels and painted and stencilled decoration on the walls.

The entrance halls and corridors of countless banks, town halls, clubs, museums, shops and public houses all over Britain were also paved with encaustic tiles.

Bunning's London Coal Exchange of 1846–1849 had a tiled floor, accompanied by hand-painted wall tiles. For William Tite's Royal Exchange, London, 1841–1844, Henry Pether designed a tiled pavement based on the Cosmati pavement at Westminster Abbey (see Plate 37). Cuthbert Brodrick's Town Hall of 1853–1858 in Leeds has a tiled floor in the entrance hall composed of 'civic encaustics'. The Rochdale town hall by Crossland, 1871, contained Minton floor tiles decorated with the Royal arms, the whole design by Heaton Butler and Bayne. Local insignia and coats of arms were a popular theme for town halls.

Charles Eastlake said in *Hints on Household Taste* (Eastlake, 1868) published in Britain and in America: 'The best mode of treating a hall-floor . . . is to pave it with encaustic tiles. This branch of art-manufacture has not only reached great technical perfection . . . but aided by the designs supplied by many architects . . . it has gradually become a means of decoration which for beauty of effect, durability, and cheapness, has scarcely a parallel'.

Between 1870 and c.1900 over one hundred firms were manufacturing floor tiles, many of them based in the Staffordshire pottery towns, including Wedgwoods, who specialized in transfer printing. The Pilkington Tile and Pottery Company employed Walter Crane and Charles Voysey to design hand-coloured tiles.

William De Morgan, from 1863, designed tiles for Morris, Marshall and Faulkner. From the 1870s De Morgan set up his own studio in Chelsea where he specialized in hand-made, hand-coloured tiles. He developed over 300 designs, some of them based on fifteenth- and sixteenth-century traditions, and took a special interest in lustre decoration. One of his most famous commissions was for the Arab Hall in Lord Leighton's house in Holland Park Road, of 1879. Many of the tiles were from Lord Leighton's Middle Eastern collection. The floor mosaics imitated Roman precedents. De Morgan moved to the Fulham pottery where he went into partnership, first with Halsey Ricardo, with whom he collaborated over the remarkable Debenham House, No. 8 Addison Road, much of which was tiled and, in the 1890s, with Charles and Fred Passenger and Frank Iles.

As the nineteenth century progressed, many leading artists designed tiles, including Christopher Dresser, Walter Crane, Sir Edward Poynter and John Moyr Smith. These were exported all over the world.

In 1902 the tiled meat hall of Harrods was completed to designs by W.J. Neatby. The floor is paved with a black and white octagon and square design, the famous *carreaux octagones*. J. Sainsbury continued to pave many of their stores with Minton tiles, often in mosaic and geometric designs, until the Second World War.

14.2 Mosaic and scagliola

Black and white mosaic floors existed in Greece and Sicily from the fourth century BC. One of the finest examples is in the palace of Philip II of Macedon, father of Alexander the Great, at Pella, near Thessalonika (see Plate 42). The palace was decorated with superb mosaic floors, dating from the end of the fourth century BC. The main courtyard has a magnificent mosaic floor of white and blue/grey lozenges, still in situ. The house of Dionysus contained a lion hunt pavement, and a portrait of Dionysus riding a panther. The House of the Abduction of Helen contained a

wonderful deer hunt, surrounded by a delicate border of leaves and flowers. Helen's abduction, in a chariot pulled by several horses, is also dramatically portrayed. The sophistication of these floors, now in the Pella archaeological museum, and the freshness of the colours, is quite astonishing. The site, reported by Chrystostom in the second century AD as reduced to a quantity of broken roof tiles, and used for many years as a source of building materials, was first excavated in 1914.

Mosaic floors were composed of a mortar base, laid on gravel, into which coloured tesserae, or marble cubes, were set while the mortar was still wet. Alternatively the pattern or cartoon was drawn on a linen base to which the tesserae then were glued, face downwards, and subsequently set in mortar as before. The linen was soaked off when the mortar had set. This method dates back to the Hellenistic period. The original cartoon panels are known as 'emblemata'.

Mosaic tesserae were made of small squares cut or knapped from large slabs of marble or stone. The sizes of the tesserae varied from 4 to 12.5 mm. Some were of coloured glass, and some gilded. Softer material, chalk for example, was sawn into bars, which were then struck with a hammer and chisel. Pincers were used to place the tesserae in position. The musivarius, or mosaic worker, was not normally the designer, and remained anonymous. Cato, writing in the first century BC, said that the client paid for the materials, and paid the craftsman only for his labour. Diocletian in 302 AD wrote that a wall painter was paid three times more than a mosaic worker. The professional mosaic designer may have been working from pattern books; each mosaic 'officina' had its own repertory of designs with guidelines to help its mosaicists (Johnson, 1995).

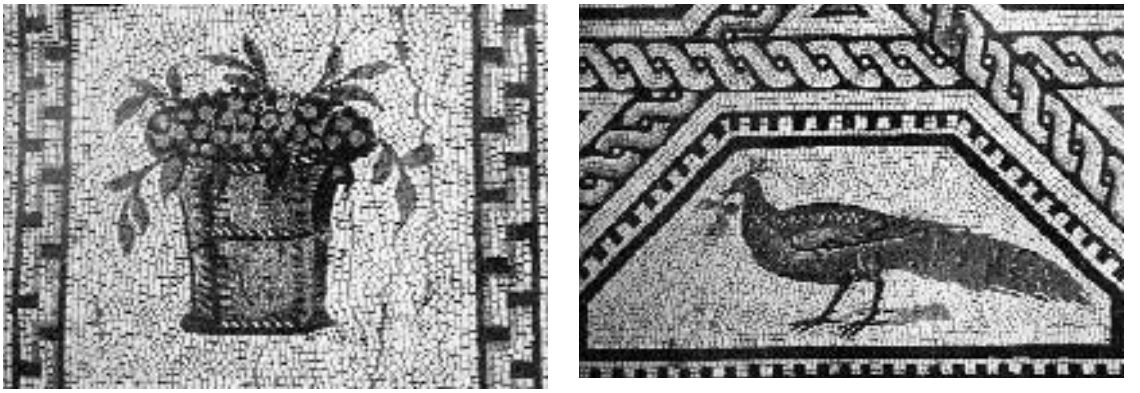
It is impossible here to do justice to the variety and quality of the many surviving Roman mosaic floors in Italy and Sicily. A few examples will have to suffice. There are outstanding polychromatic floors of the fourth century AD at Casale, near Piazza Armerina, Sicily. This was the hunting villa of a Roman governor of the third or fourth century BC. The villa was discovered and excavated from the 1950s and contains an astonishing range of mosaics. The great hunting scene shows the governor, standing between two shield bearers, wearing an embroidered cape reaching to the ankles, a tradition later adapted by the Christian church. This enormous composition includes riders, beaters, oxen carts, pulling cages for wild animals, lions, tigers, gazelles, buffaloes and hippopotami. In the centre is a lake with boats and bridges. The hunters wear tunics and capes. In another room are ten spirited female athletes wearing the Roman equivalent of bikinis, in another winged putti picking grapes, and, in a lunette, an allegorical figure, between elephants and tigers, holding a cornucopia and an elephant's tusk.

Bernard Berenson believed that the craftsmen came from Carthage and that the mosaics resemble North African examples. One of the greatest early polychrome mosaics, the 'Battle of Alexander and Darius' of the first century AD, is now in the Naples Museum (Berenson, 1960). There is a fine Nile mosaic in the Barberini Palace at Praeneste, Palestrina.

In Cologne, Germany, the superb Roman Dionysian floor mosaic, once in a house of twenty rooms lying to the south of the cathedral, was excavated in 1941. After deterioration, owing to rising damp, the whole floor was rolled up and removed, new foundations were provided, and the mosaic reinstated on its original site (Figure 14.5). Spain is also rich in Roman mosaics. Cordoba, Merida, and Italo, near Seville, all have good Roman mosaic pavements.

Many of the beautiful black-and-white Roman mosaics so common in central Italy have now been excavated. A notable example is at Hadrian's Villa, Tivoli, where a number of mosaic floors, mostly with black-and-white geometric designs, have been uncovered (Figure 14.6). There are several mosaic floors at Pompeii, one recently excavated.

In Rome classical floor mosaics were frequently found, buried beneath rubble. These were incorporated into later floors,



(a) (b)

Figure 14.5 Cologne, Germany. Second century AD. Roman villa. Dionysius mosaic floors. Details. (a) Basket of plants (b) Peacock (Photographs, by kind permission of Römisch-Germanisches Museum der Stadt, Greven Bechthold, Cologne)

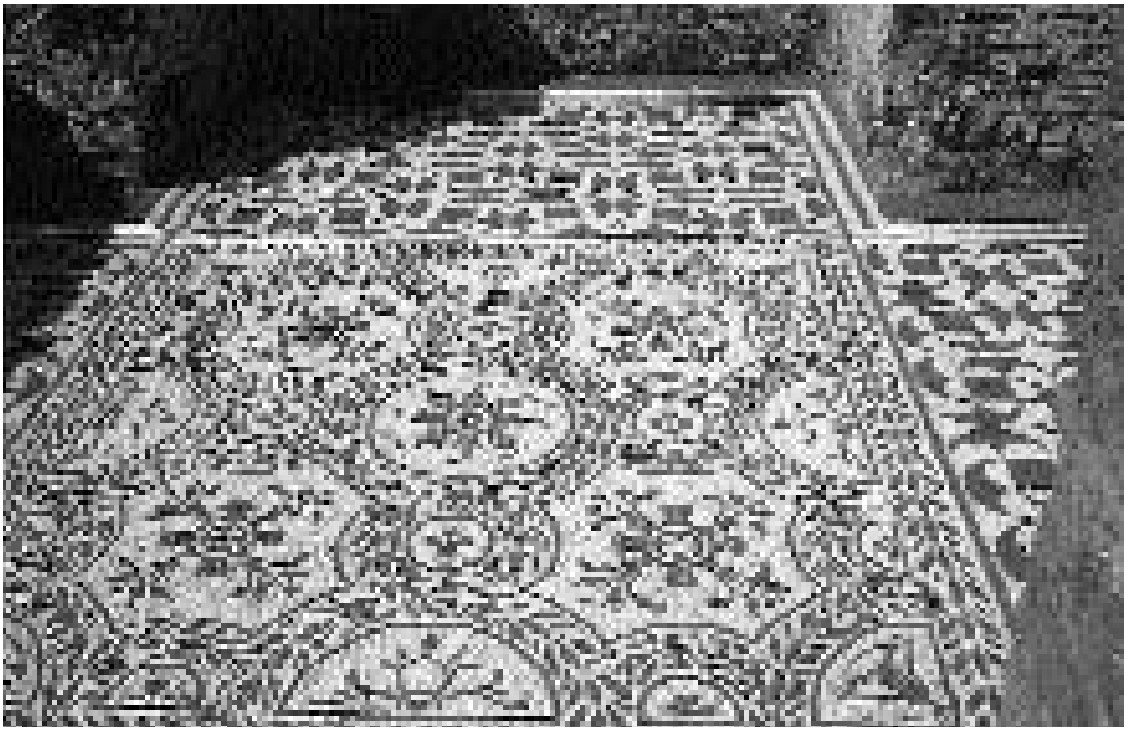


Figure 14.6 Tivoli, near Rome, Italy. Hadrian's Villa, 120 AD. Floor mosaic (Photograph, Jane Fawcett)

within the new buildings constructed on the site. The fashion for mosaic floors was revived during the Renaissance, and many of the earlier designs copied. A combination of geometric marble floors with mosaics also became popular at this period (Donato).

Terrazzo, or *opus signinum*, another traditional Italian floor, was often employed by

Palladio. Terrazzo floors were composed of small fragments of marble and stone mixed with stucco or mortar and laid on a screed of weak concrete. When set, the surface was ground and polished. They were frequently decorated with patterned borders, and occasionally embellished with coronets. These floors, known as Palladiana or Veneziana, are still made today. In Friuli, the area between Venice and Trieste framed by the mountains and the sea, the charming classical villas contain some terrazzo floors and some parquet. The Villa Manin at Passariano, built for the Manin family between 1652 and 1659, is one of the grandest. Napoleon, who stayed there in 1797 said it was fit for a doge. The villa faces an immense semi-circular courtyard, surrounded by arcaded loggias. Many of the rooms are floored with terrazzo, the salon with the Manin coronet in the centre. The chapel has an unusually splendid marble floor and the stables are paved with mosaics.

More elaborate floors are in the Castello Reale di Raconigi near Turin, altered and redecorated for King Carlo Alberto by Pelagio Palagi in 1834. The Etruscan room has a superb mosaic pavement, depicting dolphins and sea gods, with an anthemion and palmette motif repeated on the walls, decorated with Etruscan scenes. The composition is a tour de force. The Raconigi contains several other important marble and scagliola floors (Grant, 1967).

Pebble mosaics, made by setting pebbles of contrasted colours in mortar, were used externally in courtyards, stables and gardens, often laid in attractive patterns (see Plate 44). The technique goes back to Classical Greece. It was widespread in Italy during the sixteenth, seventeenth and eighteenth centuries. There are many examples in the villas of the Veneto and in Rome. The steps of the orangery in the Villa Medici are decorated with a pebble mosaic of the 1580s portraying fish and birds in contrasted colours (see Plate 45).

In Britain, the more homespun Romano-British mosaics were made from local materials providing the basic colours of red, white and blue. Brick and tiles, chalk, limestone and blue lias were cut into cubes, and set into patterns. Variants were obtained by the use of greensand or Purbeck marble for green, Pennant sandstone for purple and grey, ironstone for brown, and shale for black. Imported marble was occasionally used, and also glass tesserae, cut from blue or green bottles, used to highlight birds' tails or gladiators' costumes (Johnson, 1995).

At the Palace of Fishbourne, near Chichester, discovered in the 1960s, only a small part has been excavated; as at Pompeii and Herculaneum much of it still lies under modern housing developments. The earliest floors of this Flavian palace, dating from the first century AD are among the finest Roman mosaics in Britain. Some contain geometric lozenge designs giving a false perspective, of a type seen in seventeenth-century floors in Britain. Later mosaics, depicting cherubs riding on dolphins and other sea monsters, are contained in roundels with guilloche borders, alternating with wine cups or Cantherus motifs. They are remarkably spirited, and in some ways reminiscent of Piazza Armerina. Out of over sixty mosaics originally laid, only eighteen survive in part.

The Roman villa at Chedworth, Gloucestershire, was discovered by a gamekeeper, in 1864. Excavation of much of the site took place within the next two years, funded by the Earl of Eldon, the owner. It passed to the National Trust in 1924. The villa dates from the early second century AD and was occupied until the late fourth century. The mosaic floors were composed of red tile chippings, white limestone, Forest of Dean purple sandstone, and liassic blue and grey limestone (see Plate 43). The dining room contained mosaics of Bacchus with drunken satyrs. Other rooms are decorated with geometric designs including key fret, guilloche, and scroll leaf patterns. Over forty mosaics have been attributed to the craftsmen who designed this pavement, all from the west country, and all laid during the late third and

early fourth centuries AD. Several include Orpheus with his lute.

The figure mosaics at Bignor, Sussex of c.300 AD include Medusa, Diana with cupids as gladiators, and a delightful dolphin panel, by the master mosaicist Terentius (Johnson, 1995). Littlecote Park, Wiltshire, has a famous Orpheus mosaic, discovered in 1727 and restored in 1979, a restoration made possible owing to the remarkably detailed recordings made by Samuel Lysons when the floor was first discovered (Neal, 1981).

Of the 1500 mosaics recorded in Britain since the seventeenth century, most are now lost (Johnson, 1995). Antiquarians, from the late seventeenth century onwards, delighted in uncovering mosaic floors, recording them, and often leaving them to deteriorate. The destructive effects of rain and frost on exposed pavements was not fully understood.

Stuart Piggott, in *Antiquity Depicted* (Piggott, 1978), states that while many eighteenth-century archaeological records were inaccurate, Roman mosaic pavements in a Classical idiom that could be understood were often accurately portrayed. For example, George Vertue recorded the Littlecote, Wiltshire, mosaic in 1730 with considerable accuracy. Vandergucht's engraving of 1723 of the pavement at Ridge, Wiltshire, and Batty Langley's of Stainsfield near Woodstock, Oxfordshire, in 1736, are some of the earliest mosaics to be recorded. *Monumenta*, published in 1737, illustrated pavements at Cotterstock, Northamptonshire, and Wellow, near Bath. George Vertue, in 1747, made engravings of a pavement at Hovingham, Yorkshire, for the Earl of Burlington. Pavements in Colchester were published in *Vetusta Monumenta* in 1794. The Woodchester, Gloucestershire, pavement was drawn by Richard Bradley in 1722, recorded by the Comte de Caylus in his *Receuil d'Antiquités* in 1756, and engraved by Lysons in 1787 (Gilbert *et al*., 1987).

Samuel Lysons (1763–1819) and William Fowler (1761–1832) published very fine hand-tinted engravings, which are often the only recording that exists today of the mosaics. Fowler, an architect and antiquary, recorded Roman and early medieval mosaic pavements, some of which he had discovered himself in Lincolnshire, where he lived. His engravings, which also included medieval tiled pavements and monumental brasses, were published between 1796 and 1823. He recorded the thirteenth-century pavement in St Thomas Becket's chapel at Canterbury, and the Roman mosaic pavements at Woodchester, Gloucestershire, Littlecote, Wiltshire, Winterton, Roxby and Stonesfield, Lincolnshire, and Castle Howard, Yorkshire. This publication followed the series of engraved plates of mosaic pavements and wall paintings at Pompeii, issued by the Neapolitan government. The accuracy of these engravings and the remarkable quality of the hand colouring attracted widespread interest.

Various attempts were made to promote the use of mosaic floors. Sir Henry Wooton, in 1624, in *The Elements of Architecture*, had described mosaic as 'an ornament in trueth of much beauty, and long life, but of most use in pavements and floorings'.

Chambers' Cyclopaedia in 1738, recommended 'mosaic work' for 'The fine effect and use of pavements, composed of pieces of marble so well joined together, as that when dried they might be polished, and the whole make a very beautiful and solid body, which continually trodden upon, and washed with water, was not at all damaged'.

The Penny Cyclopaedia in 1839 stated 'The floor of the Rotunda of the Bank of England is now ornamented in black and white with compartments radiating from the centre; and such pavements certainly recommend themselves for conservatories, terraces, etc. Although mosaic itself is by far too expensive for any but very rare occasions, the effect of it may be obtained, and the beauty of its patterns produced in stain-cloth flooring' (Gilbert *et al.*, 1987).

Owen Jones, in *Designs for Mosaic and Tesselated Pavements*, 1842, outlined the practical difficulties:

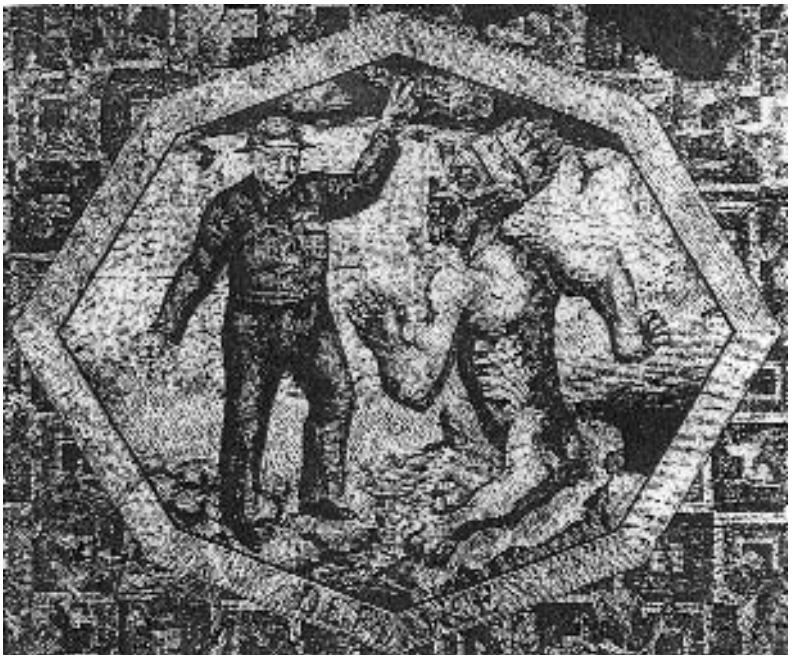


Figure 14.7 The National Gallery, London. The main staircase 1885–1887, Sir John Taylor. West vestibule mosaics by Boris Anrep, from 1928, 'Defiance', c.1942 (Photograph, National Gallery Photographic Library)

> About forty years ago, a patent was obtained by Mr C. Wyatt for a mode of imitating Tesselated Pavement by inlaying stone with coloured cement. Floors thus constructed, however, were found liable to become uneven in use, in consequence of the unequal hardness of the materials; which defect prevented their general adoption. Terra cotta, inlaid with coloured cements has also been tried and found liable to the same objection. During the last ten years, cements coloured with metallic oxides have been used by Mr Blashfield to produce imitations of the ancient Tesselated Pavements; and for work protected from the weather, the material appears to have answered tolerably well . . . Three years ago, Mr Blashfield succeeded in constructing an extensive and elaborate inlaid pavement, on the plan of the Venetian Pise floors. It was made after designs finished by H.S. Hope Esq at whose country-seat (Deepdene) in Surrey (now demolished), it was laid down.

Blashfield, who imported Italian marble for his tesserae, also collaborated with Mintons to produce a patent porcelain mosaic tile.

Roman mosaic pavements excavated in the City of London, including the Bank of England, 1805, followed by pavements in Threadneedle Street, 1841, Fenchurch Street, 1857 and Bucklersbury, 1869, influenced tile manufacturers, including Minton and Maw.

George Maw was involved in 1857 with the excavations of the mosaic pavements in Vivoconium, Shropshire, and shortly afterwards, in 1860, started the production of mosaic tiles, at Broseley, the family works nearby. George Maw's interest in tiles and mosaics increased after his travels in Italy in 1861. He sketched a number of mosaic floors, including the pavement in St Mark's, Venice (see Chapter 1). Italian marble pavements also inspired many of Maw's geometric tiles, and the range was extended when he visited the medieval tiled floors of Rievaulx and Byland Abbey (Herbert and Huggins, 1995).

In 1864 Maws patented a form of tile mosaic which was subsequently used by other manufacturers. The tiles were made of pressed clay dust. The face was then indented with lines representing the joints between the tesserae. When the tiles were laid on the floor,

these lines were filled with cement, creating the impression of a real mosaic. Mintons also made block-printed tiles to simulate mosaics, many of which are recorded in their pattern books.

The lifting of many Roman mosaic pavements led the Duke of Wellington to remove a mosaic floor from Silchester nearby and to re-lay it in the entrance hall at Stratfield Saye House, Hampshire, given to him by Parliament in 1817. The mosaic is set into a black and white marble pavement and is still there today.

By the late nineteenth century terrazzo mosaic floors were used in some commercial buildings, and a remarkable example is in the hall of the Michelin building in Fulham Road, London, 1911, designed by Francois Epinasse. The entire building is decorated with tiles, inside and out. The mosaic hall floor contains a central feature with the motto *Nunc Est Bibendum* showing a figure composed of tyres raising a glass.

The National Gallery, London, has mosaic floor on the landings of the central staircase, designed by Boris Anrep, from 1926. The mosaics represent allegorical scenes and have been cleaned and repaired recently (Figure 14.7). The Bank of England also contains extensive mosaic floors by Boris Anrep.

14.2.1 Scagliola

Scagliola is a composition made with a mixture of gypsum, glue, colouring and chips of marble. It probably originated in Italy in the seventeenth century, and was popular as a relatively cheap substitute for marble. *Chambers' Cyclopaedia* of 1738 (second edition) outlines the process.

> Manner of making MOSAIC work of gypsum, a kind of coarse talc, or shining transparent stone, found in the quarries of Montmartre near Paris, among the stones thence dug to make the plaister of Paris. – It is different from the plaister, but retains the name which the Romans gave the plaister, viz. gypsum . . . Of this stone, calcined in a kiln, beaten in a mortar, and passed through a sieve, they make a kind of artificial marbles, imitating precious stones, and of these compose a kind of mosaic work, which comes little short either of the durableness or vivacity of the natural stones; and which has this advantage, that it admits of continued pieces, or paintings of entire compartiments, without any joining visible.
>
> Some make the ground of plaister of Paris, others of freestone . . . Now to prepare the sifted gypsum to be applied on this ground, they dissolve and boil it in the best English glue, and after mixing with it the colour it is to bear, the whole is worked up together into the ordinary consistence of plaister; and then taken and spread on the ground, five or six inches thick. It must be observed, that if the work be such, as that mouldings are required, they are formed with gouges and other instruments.
>
> 'Tis on this plaister, thus coloured like marble or precious stone, and which is to serve as a ground to a work either of lapis, agat, alabaster, or the like, that the design to be represented is drawn; having been first pounced or calqued. To hollow or impress the design, they use the same instruments with the sculptors; the ground whereon they are to work, not being much less hard than marble itself. The cavities thus made in the ground, are filled up with the same gypsum boiled in glue, only differently coloured; and thus are the several colours of the original represented. To have the necessary colours and teints at hand, they temper quantities of the gypsum with the several colours, in little pots. When the design is thus filled, and rendered visible, by half polishing it with brick or soft stone; they do over it again, cutting such places as are either to be weaker, or more shadowed, and filling them with gypsum; which is repeated till all the colours, added one after another, represent the original to the life. The work being finished is scowered with soft stone, sand and water; then with pumice stone, and lastly, polished with a wooden rubber and emery. Lastly, a lustre is given it, by smeering it over with oil, and rubbing it a long time with the palm of the hand; which gives it a gloss nothing inferior to that of natural marble.
>
> If it be only required to make a variegated table, or other work of several colours,

> without mosaic figures; the process is somewhat different. – To this end, they only prepare separately, in large bowls, as many different colours as nature shews in the marble to be imitated, and after incorporating them with the gypsum and glue-water, they take a truel-full of each, and dispose them in a trough, without any order; then without mingling them, and only by cutting or crossing the gypsum of each truel once or twice with each of the rest, they given then that beautiful confusion, for which natural marbles are so much valued: Of these they can make their tables, or lay a mold, according to the work to be done.

Isaac Ware wrote in 1756, in his *Complete Body of Architecture*

> In elegant houses the floors of this nature [composition] are made of stucco, that is, of plaister of Paris beaten and sifted, and mixed with other ingredients. This may be coloured to any hue by the additional matter, and when well worked and laid makes a very beautiful floor, some of it looking like porphiry.

He continues

> . . . they are best made in the beginning of summer, for the sake of their drying. We see these miserably executed in the country, partly through ignorance, and partly through carelessness: and in good houses in London, where there are stucco floors it is too common to see frightful cracks across them. In this the workmen are generally to be censured: stucco floors are very common in many parts of Europe, particularly at Venice, where it is rare to see a crack among a thousand of them. This is more owing to the thorough tempering and working of the material, than to any secret in the composition.

While scagliola was widely used for making columns and table tops, for larger areas it was not always satisfactory in Britain, although a superb example is on the hearth and chimney-piece of the Queen's Closet at Ham House, dating from 1673–1675, inlaid with contrasted colours (see Chapter 16). In Italy it was another matter. James Adam, in his Italian diary for 1760, noted: 'The scagliola is curious, and could be used to answer different purposes, for instance for columns resembling different marbles, for tables resembling mosaic work, and for most elegant floors for baths and low apartments . . .' Sir William Chambers in a letter of 1773 to William Hey, who built a house for Sir Lawrence Dundas in St Andrew's Square, Edinburgh, makes a good case for it: 'The talk your Proprietor mentions is probably the Scagliola which is an imitation of Marble composed of talk, ising Glass and mineral Colours of different Sorts. It is when well done nearly as hard as marble & as beautiful in every respect. The Price is from five or six to 12 shill pr. foot superficial & the best makers of It in England are Messrs Ritter & Bartoli, Newport Street, near Newport Market, London, who imitate almost any Sort of marble You please & also make very beautiful Ornaments of It.' The Bartolis provided scagliola for both Adam and Wyatt, which was also used for floors.

By 1833, J.C Loudon, in his *Encyclopaedia of Cottage, Farm and Villa Architecture and Furniture*, says 'The permanent Covering of the Floors of Rooms is, for the most part, of boards; though scagliola, and various imitations of marble and stone, are common on the Continent, and especially in the villas of Italy'. And 'Various descriptions of plaster floors are in use for villas, which may either be painted in imitation of marble, or kept covered by carpeting. In some cases the preferable mode is to paint the margin of the floor round the room in imitation of marble or other stone, or of oak, or of some other dark wood; or to finish this margin with scagliola, and cover the interior with carpeting'.

Although many scagliola floors must once have existed, owing to the many references to them, very few have survived. Adam's anteroom at Syon (see p.147) and the floor of the Saloon at Wilbury Park, Wiltshire, a classical design, are two of the few important known examples. Adam's drawing for the pavement of the sculpture gallery at Newby Hall, never executed, was probably intended for scagliola.

14.3 Composition and plaster floors

Hardwick Hall, built in the 1590s, had, according to *Davies's View of Derbyshire* written in 1805, floors of stone or plaster in every room. 'On the whole it is an ill-contrived, and very inconvenient domestic residence'. Another complaint was about the cold, recommending 'an allotment of £300 for carpets and grates' (Gilbert *et al.*, 1987).

Plaster floors were laid in passages, and upper rooms of many houses in the eighteenth century. *The Builder's Dictionary* of 1734 gives full details for the preparation of a composition floor:

> Take Two Thirds of Lime, and one of Coal Ashes well-fitted, with a small Quantity of loamy Clay; mix the Whole that you intend to use together, and temper it well with Water; making it up into a Heap, let it lie a Week or ten Days, in which Time it will mellow and digest: Then temper it well over again, and be sure that your Quantity of Water does not exceed, but rather that it may obtain a mellow Softness and Toughness from Labour: Then heap it up again for three or four Days, and repeat the Tempering very high, till it becomes smooth and yielding tough and glewy.
>
> Then the Ground being levelled, lay your Floor therewith about two and a half or three Inches thick, making it smooth with a Trowel: The hotter the Season is, the better; and when it thoroughly dry'd it will continue Time out of Mind.
>
> This makes the best Floors for Houses, especially for Malt-Houses; but as for those who cannot get these Materials, or go to the Charge of them, they may take of clayey Loam and new soft Horse-Dung one Third, with a small Quantity of Coal Ashes, if they can be had, and temper there after the aforementioned Manner and lay the Floor with the Stuff three or four Inches thick, smooth and even, which will cement, become hard, strong and durable, being done in a hot and dry season; good for Cottages, Barns, and other small Houses.
>
> But if any would have more beautiful Floors than these, they must lay their Floors even, smooth, and fine, either with the first or last mentioned Flooring; then take Lime made of Rag-Stones, and temper it with a little Whites of Eggs, the more Eggs the better, to a very high pitch, with which cover your Floor about a quarter or half an Inch thick, before the under Flooring be too dry, that they may well incorporate together: This being well done, and thoroughly dry, if sometimes rubbed over with Mops or Cloths, with a little Oil thereon, it will very beautiful and transparent, as if it were pollished Metal or Glass, provided the Eggs and Lime were thoroughly tempered, and otherwise well performed. Sir Hugh Platt gives us a Receipt for making an artificial Composition where with to make smooth, glittering, and hard Floors; and which may also serve for plastering of Walls.
>
> 'Ox Blood and fine Clay tempered together', he says, 'makes the finest Floor in the World; and that this Mixture laid in any Floor or Wall, will become a very strong and binding Substance.'

Isaac Ware said that 'boards and plaster are in general the kinds to be used in upper stories' and many have survived, at Hardwick Hall, Temple Newsam, Calke Abbey, Hampton Court and Grimsthorpe Castle. At Newby Hall the attic floor is of red plaster (Gilbert *et al.*, 1987).

14.4 Marble and stone pavements

Marble was widely used to create decorative pavements from the early Renaissance onwards. Vitruvius's ten books of architecture, circulated in illustrated editions in the sixteenth century, promoted Renaissance ideas of design and proportion. The interest in pattern books was introduced by Serlio, whose treatises were first published in 1537, and by Palladio's *I Quattro Libri del'Architettura* published in 1570. Both represent the rebirth of classical ideas, and both were circulated in France, Germany, Holland and Britain, a circulation made possible by the invention of printing. Serlio's designs were used, not only in Italy, but in France at Fontainebleau, from whence they spread, as did other Renaissance

designs, to Germany, Holland and England. Later translations made these books more widely accessible.

The revival of interest in Renaissance design brought about by Serlio and Palladio manifested itself in a new enthusiasm for patterned floors throughout Europe. Even before the first floor pattern books were published, certain simple designs, based on Renaissance examples were well known.

In Britain, black-and-white chequered marble was the most popular floor pattern in the seventeenth century, particularly for entrance halls. An early example, dating from 1612–1621, is the marble hall at Bolsover Castle, Derbyshire. Built by Sir Charles Cavendish, son of Bess of Hardwick, the castle keep, possibly designed by Smythson, is strongly influenced by Serlio.

The portrait by Mytens of Thomas Howard, Earl of Arundel, c.1618, portrays him in the sculpture gallery at Arundel House, The Strand, floored with black and white chequered marble and decorated with his newly imported antique statues. At Ham House, Richmond, the great hall, 1610, contains the original black-and-white chequered marble floor (see Chapter 16 and Plate 64). The hall floors at Belton House, Lincolnshire, and at Powis Castle, Wales, both of the late seventeenth century, are also of chequered marble, that at Powis acting as a foil to the spectacular staircase attributed to William Winde, in which the treads are inlaid with holly.

A more elaborate floor was the fictive cube design, composed of perspective cubes, giving the illusion of three dimensions. It was introduced into Britain by Walter Gedde in 1615, in his *Booke of Sundry Draughtes*, widely used in Europe, in the seventeenth and eighteenth centuries.

A radiating design of marble chequers was incorporated in the mid-sixteenth-century circular chapel of the Château of Anet by Philibert de l'Orme, in the entrance hall of the Queen's House, Greenwich, by Inigo Jones in 1635 (see Plate 46), and in the marble hall of Wentworth Woodhouse, by John Carr of York in the eighteenth century (Gilbert *et al*., 1987).

One of the most comprehensive pattern books for historic floors was published by C.A. d'Aviler in France in 1691. After spending five years in Rome, he settled in Montpelier. His *Cours Complet d'Architecture* contained many Roman floor designs and also practical advice on construction (see Figure 14.8). He recommended Dutch tiles for bathrooms, 'cabinet' rooms and grottoes. Coloured plaster and scagliola floors were only suitable for areas protected from wear, parquetry for bedrooms, plain stone flags for churches, kitchens and refectories, flags in hexagonal or octagonal shapes for halls, galleries and dining rooms. D'Aviler's *carreaux octagones* pattern, originating in classical Rome, became popular for paved entrance halls throughout Europe. Several of his patterns could be used for both marble and parquet floors. He included designs to complement domed, apsidal or compartmental ceilings. Where contrasted colours were used he advised that marbles of equal hardness should be chosen, to avoid differential wear. One of Serlio's designs was adapted by d'Aviler for marble floors, and used in the marble hall at Petworth and in the halls of Crowcombe Court and Bowood (Gilbert *et al*., 1987).

Petworth was rebuilt from c.1688 for the 6th Duke of Somerset, possibly by Daniel Marot. The baroque marble hall (see Plate 47), showing strong Dutch influence, has a marble floor of 1692 by the mason James Sayers, paved in white squares and black diamonds, a variant of the octagon and square design with the colours reversed. The hall survived both the fire of 1714 and the nineteenth-century alterations carried out by the 3rd Earl of Egremont. It was completed in time for the visit of King William III in 1693, and has remained virtually the same ever since.

Dyrham Park, Avon, was adapted from the Tudor house for William Blathwayt from 1692, first by the architect Hauduroy, and then, from 1698, by Talman. Blathwayt, having started his diplomatic career in The Hague, knew the latest

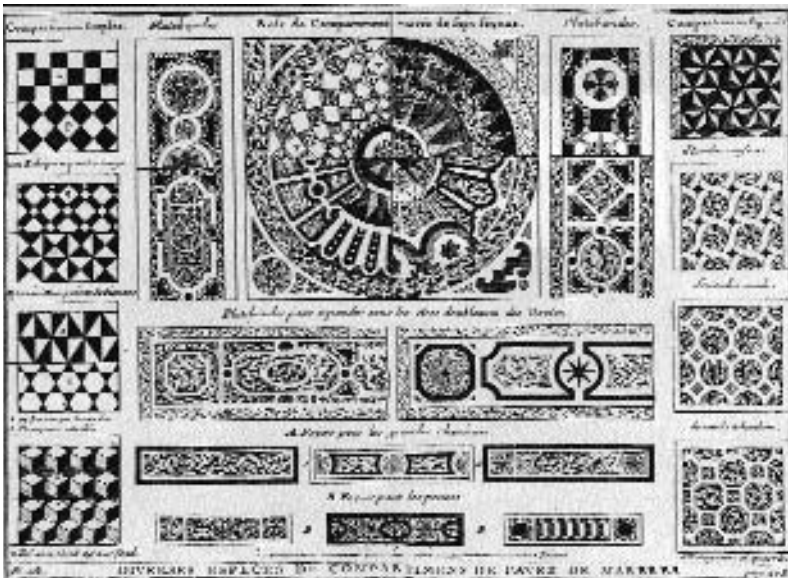


Figure 14.8 C.A. d'Aviler *Cours Complet d'Architecture,* 1691. Designs suitable for marble or parquet decorative floors, some derived from Serlio. Widely circulated in Europe

Dutch and French styles. In the west hall he chose the *carreaux octagones* pattern, composed of white stone squares cornered with black marble lozenges. It is still there today. The black-and-white chequered marble floor in the ante hall may also be original, but relaid.

Celia Fiennes, in her *Rides Through England on a Side Saddle* (1685–1703) (Morris, 1947) thought it worth mentioning the marble floors. At Coleshill and Burghley she found the hall floors 'paved with black and whyte marble', while at Chatsworth the floor of the chapel was of black and white marble, the 'batheing roome ... the pavement mixed one stone whyte, another black, another of the red rance marble.' All were quarried on the estate. The present black and white chequered marble floor in the hall was laid by John Carr of York in 1779 (Gilbert *et al.*, 1987). Celia Fiennes visited Chippenham Park in Norfolk, in 1698, and remarked on the hall 'paved with freestone (octagons) a square of black marble at each corner'.

The eighteenth century saw an increasing interest in patterned marble floors, and the publication of floor designs. Batty Langley, in *Ancient Masonry* published in 1736, refers to a pavement of 'White, Black and Dove Colour'd Marble ... The Angles of the Cubes ... which in the Dusk of an evening appear as so many solid bodies not to be walked on'. He also describes a pavement 'where the Cubes are lying on their Bases, and appear as Steps, which makes this Disception very agreeable'.

Ancient Masonry was followed by Langley's *City and Country Builders' and Workmans' Treasury of Designs* published in 1740 containing 'Twenty-seven designs of Marbled Pavements for Halls, Baths, etc. the last nine of which, are envision'd with thirty-six Varieties of Frets, Guillochi's and Borders'. Some of these designs derive from Serlio. J. Carwitham, an engraver formerly working with Batty Langley, brought out his own set of floor designs in 1739, entitled 'Various Kinds of Floor Decorations represented both in Plan and Perspective Being useful Designs for Ornamenting the Floors of Halls, Rooms, Summer Houses etc. Whether in pavements of Stone or Marble, or with Painted Floor Cloths' (see Figure 14.9). Many of these patterns are identical to those published by Langley, but they have the addition of perspective views enlivened with figures. James Gibbs, who copied some of d'Aviler's designs in his *Book of Architecture*, published in 1728, paved the

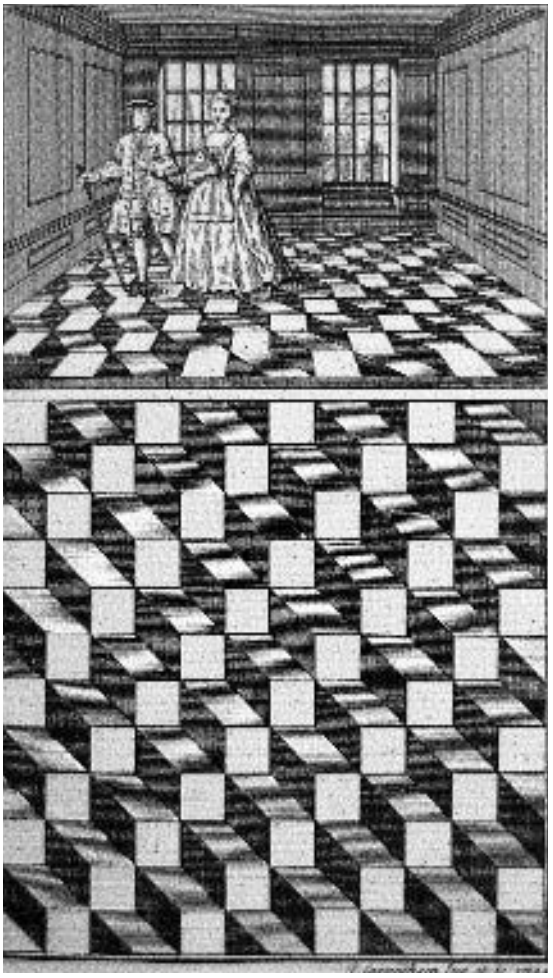


Figure 14.9 John Carwitham. *Various Kinds of Floor Decorations*, 1739. Influenced by Batty Langley, with whom he worked, and by d'Aviler. All his designs were enlivened by perspective scenes, with figures (Temple Newsam)

Radcliffe Library in Oxford with 'Portland Stone, intermixed with red Swedish or Bremen stone' as being preferable to marble owing to condensation. He felt that marble was 'fitter for churches, Porticos, Common Halls, and Passages, than a Library because the Air, condensing upon it, occasioned by its Hardness . . . makes the place Damp, especially where no fire is kept' (Gilbert *et al.*, 1987).

Castle Howard in Yorkshire has magnificent floors in the Temple of the Four Winds, by Vanbrugh (1724–1726) and in the mausoleum, where the circular pavement has a Greek key-fret brass inlay probably designed by Hawksmoor himself (1728–1729).

The hall pavement at West Wycombe Park by Borgnis of 1754–1755 laid over a hypocaust, has chequers of coloured marble and stone, laid as lozenges and surrounded with a large key-fret border. The floor was relaid in 1964 with Portland stone and Forest of Dean sandstone.

Berrington Hall, Herefordshire (1778–1881) by Henry Holland, a simple Neo-classical house, has surprisingly rich interiors. The square marble hall is enhanced by a floor of black, white and grey marble in an octagon and square design reflecting the ceiling. The staircase hall, another brilliant spatial composition, contains a black and white chequered marble floor.

Robert Adam, inspired by the magnificent pavements of Rome, designed interiors, in which the floors were an essential component of an integrated architectural composition. Two of his finest rooms are at Syon House, Isleworth, designed in 1761. The chaste black and white chequered marble floor of the great hall (see Figure 14.10) has bands of key-fret, corresponding with the ceiling panels, while the alcove has a coffered ceiling reflected in a radiating floor pattern. The ante-room has, to complement its superbly rich Neo-classical interior, a scagliola floor, the design derived from Serlio's *Book IV, Folio 68*. It consists of octagons and circles embellished with floral motifs in red, yellow, blue, green, brown and red. The floor we see today was relaid in 1831–1832, replicating the original design, for £900 (Gilbert *et al.*, 1987).

Adam designed floors to complement his distinguished entrance halls at Osterley Park, Middlesex, Kedleston, Derbyshire and Newby Hall, Yorkshire. At Osterley (see Plate 48), the fine entrance hall of 1767 decorated with giant pilasters, intersecting panels of plaster trophies and semi-circular alcoves, has a grey and

Figure 14.10 Syon House, Isleworth, 1761. Robert Adam. The Great Hall. A superb Neo-classical interior, leading to Adam's ante-room with its magnificent coloured scagliola pavement (Photograph, National Monuments Record)

white patterned stone floor with a central oval, answering the coffered ceiling design. Adam referred to 'compartment ceilings' – 'a name given to all ceilings that are divided into various panels, surrounded with mouldings', of which this is a fine example. The marble hall at Kedleston (see Plate 49) of 1763 is dominated by twenty giant fluted marble Corinthian columns. The floor of Hopton Wood stone inlaid with white Italian marble, has an elliptical central feature of curvilinear bracts, providing a severe foil to the elaborate plaster-work.

James Wyatt designed a superb floor for the entrance hall at Heveningham, Suffolk, completed in 1784 (Figure 14.11). The central section of red and black marble on a stone base is composed of circular motifs, contrasted with fictive cube panels.

The guard room at Belvoir Castle, Leicestershire, of the early nineteenth century, has a marble floor with a plaited design derived from Batty Langley. The staircase hall at Ickworth, Suffolk, has a traditional chequered marble floor designed by Sir Reginald Blomfield in 1909 to complement his new staircase.

Figure 14.11 Heveningham Hall, Suffolk, Sir Robert Taylor 1787. James Wyatt. Entrance hall, 1784. Fine marble floor, combining fictive cube design and geometric elements (Photograph, Christopher Hanson-Smith)

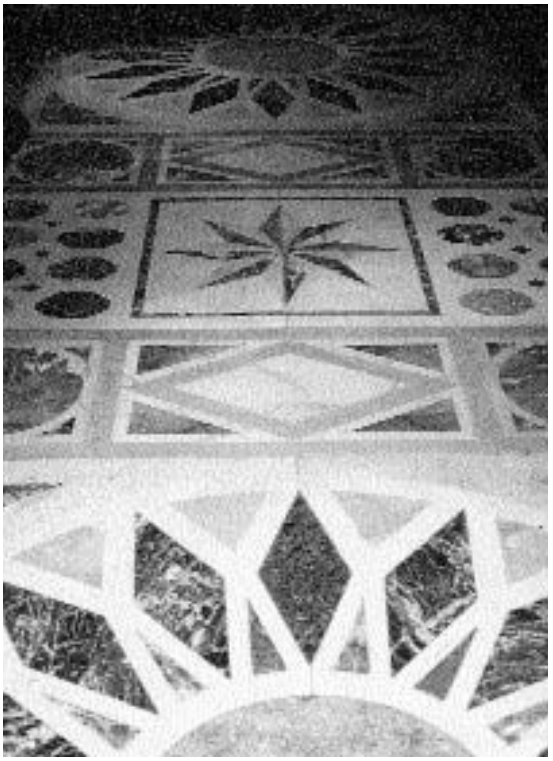


Figure 14.12 Chatsworth, Derbyshire. North corridor, 1841. Sir Jeffrey Wyatville. Marble floor by Leonardi, a Roman craftsman, working on the Forum (Photograph, Jane Fawcett)

Figure 14.13 The Royal Courts of Justice, London, 1874. G.E. Street. The great hall, decorative pavement (Photograph, National Monuments Record)

Highclere Castle, Hampshire, was recreated in sumptuous Italianate Gothic by Sir Charles Barry for the Earl of Carnarvon in 1839–1842. For the entrance hall, William Butterfield in 1864 designed a brilliant multi-coloured marble geometric floor, with the initials CC for Carnarvon and Chesterfield (Girouard, 1979).

The splendid Classical and Baroque palaces of Italy, with their decorated marble floors, make our British examples appear rather homespun. The hot dry climate, and the availability of a wide variety of colours and types of marble created a tradition, started by the Romans, and still continuing today. During the early fifteenth century marble floors were composed of small sections, made up of circles, squares, oblongs and triangles. The individual pieces gradually increased in size by the late fifteenth and sixteenth centuries. In the seventeenth century Rome was transformed by the monumental Classical buildings of Bernini and Borromini. Much of their work was in the form of ecclesiastical commissions from three successive Popes, but a few of their palazzi, designed for noble families, have survived. Notable is the Palazzo Barberini (1631–1650) by Bernini with assistance from Borromini. The huge Gran Salone on the piano nobile, or first floor, still retains its original painted decorations, offset by fine marble floors.

Another grand palazzo, the Palazzo Colonna, by Antonio del Grande (begun 1654) and Girolamo Fontana, completed 1670, also has a great gallery or Gran Sala on the first floor, with a monumental coloured marble

pavement of circles, octagons and squares to complement the gorgeous classical decoration, the heroic ceiling paintings and the great family collection of pictures. The development of an enfilade of principal rooms on the first floor led to the design of magnificent formal staircases, to create a suitably grand approach.

Many of the villas of the Veneto have terrazzo floors in the main rooms and, outside, elaborately paved courtyards. The Villa Garzoni at Ponte Casale, near Padua, by Sansovino (1537–1550) has a courtyard paved in a design of squares, crosses and roundels, in contrasted stone, with a well-head in the centre. The Villa da Porto Colleoni, near Vicenza, has exceptional eighteenth-century stables attributed to Francesco Muttoni. The stone floors are paved with cobbles, intersected by stone roundels with large stone paviours in an intricate design of squares, rectangles, octagons and circles. The stalls are separated by marble columns surmounted by putti.

Fischer Von Erlach trained in Rome. The buildings he designed in Austria were mostly ecclesiastical, and restrained in comparison with Italian Baroque. The royal palace of Schönbrunn, one of the most notable, has been substantially altered, but the Winter Palace of Prince Eugene in Vienna of 1695, with its superb entrance hall and monumental stone staircase, supported by life-size caryatids, is a triumph of Austrian Baroque.

In Germany the arrival of Baroque was later than in Italy. An exceptional example is the Neues Schloss Schleissheim near Munich (see Plate 50), built for the Elector Max Emmanuel and designed by Effner and Zucalli. Started in 1701, the magnificent lower hall is paved with a chequered marble design, while the Kaisersaal of 1725 contains a pink and cream chequered floor, with an octagon and square pavement on the landings traceable to Serlio. The Schloss was damaged during the last war, and restored.

More elaborate is the marble floor in the oval cupola room of the Sans Souci Palace, Potsdam (see Plate 51) completed for Frederick the Great in 1745–47. The floor is composed of radiating panels, each containing a Rococo flower or leaf motif, while the sumptuous marble hall has another fine marble floor. Schloss Benrath near Düsseldorf was begun in 1756 for the Elector Palatine Charles Theodore, and the interiors completed in 1771. The circular Kuppelsaal has a radiating chequered pavement with a central star motif.

In France, decorated stone and marble floors were usual in the entrance halls and staircase halls, while the upper rooms often had parquetry. However, some of the grander châteaux also had marble floors to the principal rooms upstairs. The Château du Champs de Bataille near Le Neubourg, built in 1606–1701, has, in the grand vestibule on the first floor, an impressive octagon and square black and white marble pavement. François Mansart's famous Château de Maisons, near Paris, completed in 1651, contains, in the entrance hall and staircase hall, splendid chequered marble floors to enhance this grand Classical interior. The hall and stairway are ornamented with groups of putti by Philippe de Buyster. The Château de Vaux-le-Vicomte near Melun by Le Vau, of 1657–1661, has one of the most magnificent interiors in France. The king's bedroom, intended by Fouquet for Louis XIV's visit, is one of the most spectacular rooms of the château, with an elaborate floor reflecting the sumptuous ceilings of lunettes and roundels painted by Lebrun.

The charming Pavillon de Musique de Madame at Versailles of 1781, a small rotunda in the park of Versailles, has a *carreaux octagones* marble floor design. The panels of the rotunda are decorated with delightful sylvan scenes.

In Holland, the seventeenth century was known as the Great Century. Handsome brick houses grew up along the canals of Amsterdam, Utrecht and Leiden, built by rich burghers. The Mauritshuis in The Hague, of 1633, is one of the finest of them. The interiors were plain, with beamed ceilings, long lattice windows, tables covered with a rug, and, invariably, chequered marble floors.

These were often in contrasted colours of red or black and white, with, in the grander houses, key-fret borders. They are portrayed, in minute detail, in the domestic interiors painted by Vermeer, Jan Steen and Pieter de Hooch.

14.5 Parquet and marquetry floors

The term parquet originated in France in the early seventeenth century, and was first used to describe the raised area behind a balustrade, then laid with a more elaborate floor. The term was later applied to the whole floor. The definition of parquet is flooring of thin hardwood laid in patterns on a wooden sub-floor. The design of the famous Parquet de Versailles was derived from Serlio and Palladio (see Figure 14.16) and copied by d'Aviler in his *Cours Complet d'Architecture* of 1691. It became the standard floor for the formal rooms of French châteaux in the seventeenth and eighteenth centuries. The design is of interlaced diagonals, set within squares. The Galerie d'Hercule of the Hôtel Lambert, Paris, by Le Vau, completed in c.1650, decorated with the labours of Hercules, is floored with Parquet de Versailles. So is the rococo Salon de M. le Prince in the Château de Chantilly, near Paris of 1722. The lovely Salon Ovale at the Hôtel Soubise in Paris of 1738–1740, decorated by Germain Boffrand for the Princesse de Soubise in a flowing rococo style, has Parquet de Versailles. An early example survives at the Château de Mormatin near Tournus, Burgundy (Gilbert *et al.*, 1987).

Herringbone parquetry, a common variant, consists of parallel rows of diagonals. The spectacular Salle des Gardes de la Reine at the Château de Versailles, by Le Vau c.1670, with its marble wall panelling, painted ceiling, carved woodwork and herringbone parquetry is one of the finest rooms in the Palace.

In Britain, floor boards of plain oak were more common than decorative parquet floors.

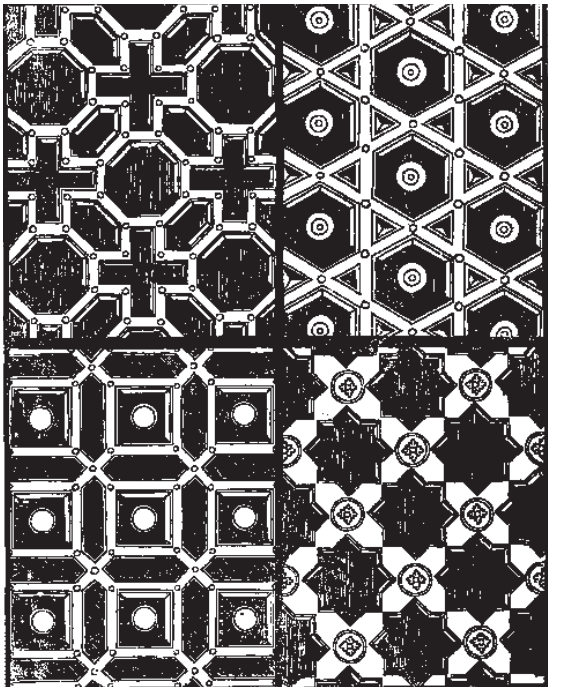


Figure 14.14 Serlio, *Book IV, Folio 68*, English Edition, 1611. Design adapted for parquetry and marble (Temple Newsam)

Thomas Sheraton, in *The Cabinet Dictionary* of 1803, outlines methods of laying boarded floors:

> There are three methods by which floors are laid. First, with plain jointed edges, and nailed down. Second, jointing and ploughing the edges to receive a winscot tongue about an inch broad, and a bare quarter thick, by which the dust is prevent from falling through, in cases where there is no ceiling. These may be nailed at every set board at the edge, so that no nails be seen. Third, when they are laid with douwells of oak-board into the edge, and every one set as they are laid. In this method the pieces of wainscot, let in half an inch onto the edge of the board, and rather more into joists. This is a troublesome but most effectual method, and by a little practice may be done with greater facility, than is at first apprehended. The ancient floors of a good quality, were generally made of oak boards, and very curiously laid, by forking the end together in large floors, where more than one length was wanted.

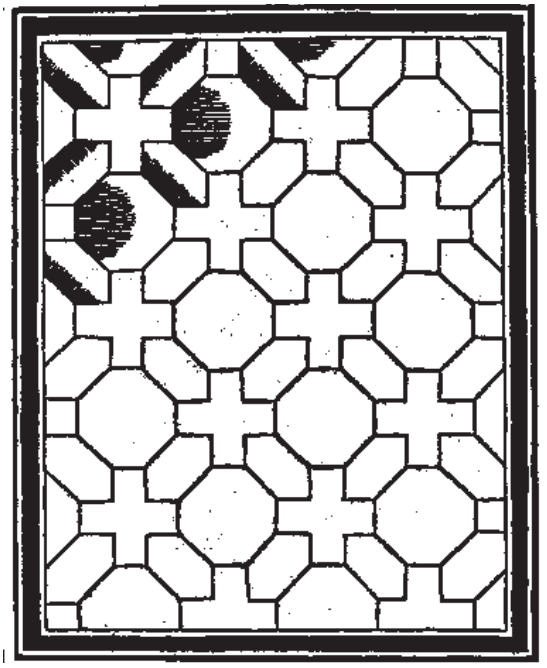


Figure 14.15 Walter Gedde, *Book of Sundry Draughtse*, 1615. Designs for parquet (Temple Newsam)

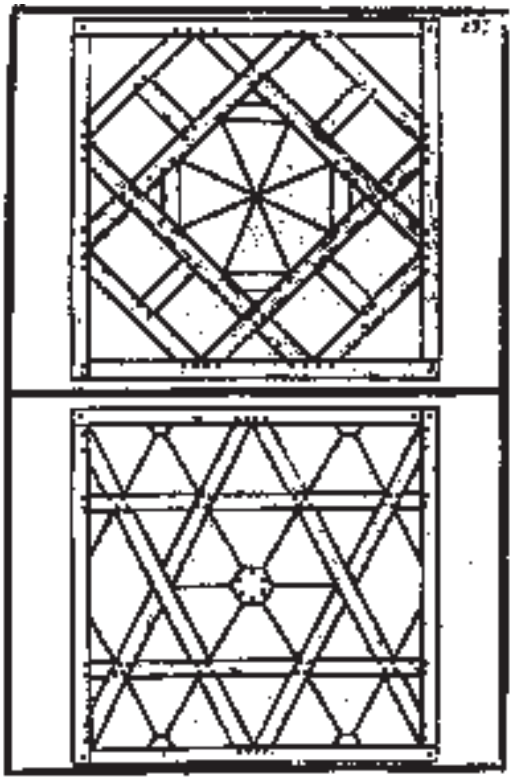


Figure 14.16 Richards' translation of le Muet's *Palladio*. Parquetry design used for Queen Henrietta Maria's rooms at Somerset House, London, 1661–62. Possibly the earliest use of parquetry in England (Temple Newsam)

There was no standard width for floor boards in the seventeenth and eighteenth centuries, and variations in width can often be found in one room. Early floors, usually of oak, were made of wider boards, but by the nineteenth century, boards became narrower and by 1904 *Chambers' Cyclopaedia* recommended that 'flooring boards should not be more than 6 inches broad and in the best floors they do not exceed 3 or 4 inches'. The thickness also varied considerably, and in 1833 Loudon referred to boards being 'sometimes laid down in large houses three inches thick' to prevent warping, and 'to lessen the risk of their being burnt through by fire'.

The Builder's Dictionary of 1734 gives the cost of 'boarding floors in and about London', with considerable variations according to the type of wood used, and the type of construction.

Decorated floors were immensely more expensive. Sir William Craven, in 1686, wrote to Lord Craven about floors at Combe Abbey, 'The flooreing of the Cedar Closset with oake boards, which are already provided for it, will cost workmanship about 03 00 00. If done with an inlayd Floore, what Captin Winde can agree with Mr. Syms, for doeing of it, and carriage from London, I can give noe estimate of the charge'. Williame Winde also worked at Chirk Castle 1673–1678, Cliveden 1674–1677, and Powis c.1685, where he designed the grand staircase (p.144).

The earliest use of geometrical parquetry in England was in the mid-seventeenth century, probably introduced by Queen Henrietta Maria on her return from France at the Restoration. John Evelyn, in his *Account of Architects and Architecture* said 'not to be forgotten are the Floorings of Wood which Her Majesty the Queen Mother has just brought into use in

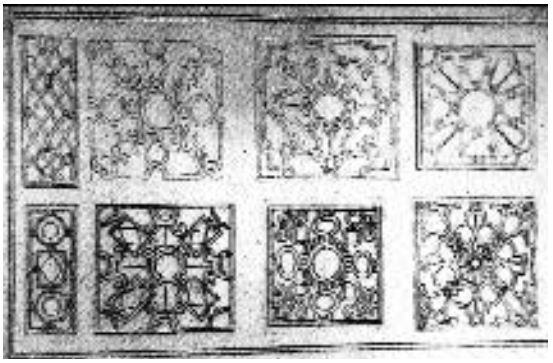


Figure 14.17 Patterns for parquetry, c.1691. Used in royal palaces and other important buildings (from Thornton, 1978)

England at her Palace of Somerset House, the like whereof I directed to be made in a Bed-Chamber at Berkeley House. The French call it Parquetage, a kind of segmentatum opus, and which has some resemblance to these magnificencies' (Fowler and Cornforth, 1974). Godfrey Richards translated Le Muet's *Palladio*, illustrating the parquetry used at Somerset House in 1683 (Figure 14.16), which he describes as 'a curiosity never practised in England'. Shortly after Somerset House, very fine marquetry floors, inlaid with the ciphers of the Duke and Duchess of Lauderdale, were laid at Ham House, London, in 1673 (see p.175).

The term marquetry refers to an area of wooden flooring inlaid with wood of contrasting colours to create patterns or ciphers. Celia Fiennes, in 1694, visited Stowe where 'some of the floors are inlaid fine pictures', and the Chamber of State at Nottingham Castle 'inlay'd with Cyphers and the Coronet'. At Burghley, Lincolnshire, 'the floores were Inlaid in severall roomes', and at Chatsworth, Derbyshire, she found 'the floores of the roomes are all finely inlaid'. Many of the seventeenth-century parquet floors on the first floor are still there. At Ashtead Park in Surrey she saw 'some closets with inlaid floores' and also remarked on the staircases with inlay on the treads and landings. At Durdans, the staircase was 'noble and lofty, all plain wanscoate only the half paces inlaid', while at Mr Rooth's house in Epsom 'the half paces are strip'd, the wood put with the grain, the next slip against the graine, which makes it look pretty as if inlaid.' At Broadlands, Hampshire, 'the halfe paces are inlaid with yew wood, which lookes a yellowish red, in squaires; they laid on the next storey with a space of this inlaid worke of a good bigness the whole compass of the Staircase'.

Staircases were also decorated with inlaid treads and risers, often with marquetry on the half landings. The Great Staircase at Powis Castle, Montgomeryshire, of c.1674–1685, rises from a black and white chequered marble hall, with inlaid treads, and an octagonal motif on the landing. The staircase at Longnor Hall, Shropshire, of c.1670, also has inlaid treads and risers, superb carved balusters, with Sir Uvedale Corbett's cipher on the second landing. The walnut (west) staircase of 1694 at Dyrham Park, Avon, is cantilevered, and similar in design and date to those at Hampton Court and Petworth. It is constructed of Virginian walnut, with French parquetry on the half landings. Mr Blathwayt, the owner, had seen such stairs in France. The handsome cedar east stair by Talman, of 1698, also cantilevered, has treads of Virginian walnut and risers of American cedar, with, on the half landings, a marquetry design of radiating stars.

Boughton House, Northamptonshire, regarded by Nikolaus Pevsner as 'the most French looking seventeenth century building in England' (Pevsner, 1961), was remodelled for the first Duke of Montagu from 1683. Having been Ambassador in Paris he was aware of the latest French fashions, and introduced parquetry floors and stairs, possibly copied from Versailles. Some are still there today. Thorpe Hall, Peterborough, also has inlaid stairs of the same period.

Horace Walpole visited Drayton House, Northamptonshire, and remarked on 'the Duchess of Norfolk's closet, the floor inlaid with her and Sir John's cyphers and looking glass in the ceiling' (Fowler and Cornforth, 1974). This floor, also decorated with

marquetry birds and flowers, was laid, after 1697, by the Duchess of Norfolk and Sir John Germaine. It is still there. At Beningbrough, Yorkshire, the half landing is inlaid with the coat of arms of John and Mary Bourchier, 1716. The superb marquetry floor of the landing from 22 Hanover Square, now in the Victoria and Albert Museum, is inlaid with the arms of Lord Carpenter.

Mawley Hall, Shropshire, has geometric inlay on the risers, and a grid pattern of stars, circles and diamonds inlaid on the landings, of c.1730. There is also an unusual marquetry floor in the drawing room, with a central octagonal design.

As the eighteenth century progressed, inlay became more sophisticated. One of the grandest staircases is at Claydon, Buckinghamshire, of 1768 (see Plate 74). The mahogany risers and treads are inlaid with marquetry, the landings inlaid with the Verney arms and crest, and the soffits are decorated with plaster stars. Box, mahogany, ebony and ivory combine to produce a remarkable ensemble, completed by the superb gilded ironwork balustrade. One of the elaborate marquetry floors at Mereworth, Kent, resembles a design in d'Aviler's *Foyers pour les Grandes Cheminées*, while at Mersham-le-Hatch, in Kent, the hall, of the 1760s, has a parquetry pattern derived from Serlio (Gilbert *et al.*, 1987). The saloon at Russborough, County Wicklow, Ireland, by Richard Cassels and Francis Bindon completed in 1750, has a fine marquetry floor with a central star motif.

George Dance designed inlaid Neo-classical floors at Cranbury Park, Hampshire, c.1780, and for the music room at Mount Stewart, Co. Down, 1782–85 (see Plate 52). The delicate inlaid floor in the Temple of the Winds, 1782–1783, by Athenian Stuart (see Figure 14.18), combines mahogany, American walnut, sycamore and bog oak, to create a subtle octagonal design to enhance this charming room, with views over Strangford Lough. The Casino at Marino, Dublin, by William Chambers, also contains fine marquetry floors, recently restored (see Figure 14.19). The library floor at Sledmere, Yorkshire, originally

Figure 14.18 Mount Stewart House, Co. Down, Northern Ireland, 1782–1785. James (Athenian) Stuart. Temple of the Winds. Marquetry floor (Photograph, Jane Fawcett)

of c.1780, is also of exceptional delicacy, echoing the fine plasterwork on the vaulted ceiling. Ballyfin, in Co. Leix, Ireland, has remarkable marquetry floors in the rotunda, and, even more elaborate, in the saloon, carried out for Sir Charles Coote in the 1820s (Fowler and Cornforth, 1974).

By the mid-eighteenth century, large carpets became more readily available and the use of inlay and parquetry declined. Isaac Ware in *A Description of Bath* said, in 1756 'the use of carpeting . . . has set aside the ornamenting of floors . . . It is the custom . . . to cover a room entirely; so that there is no necessity of any beauty or workmanship underneath' (Fowler and Cornforth, 1974). However, by the end of

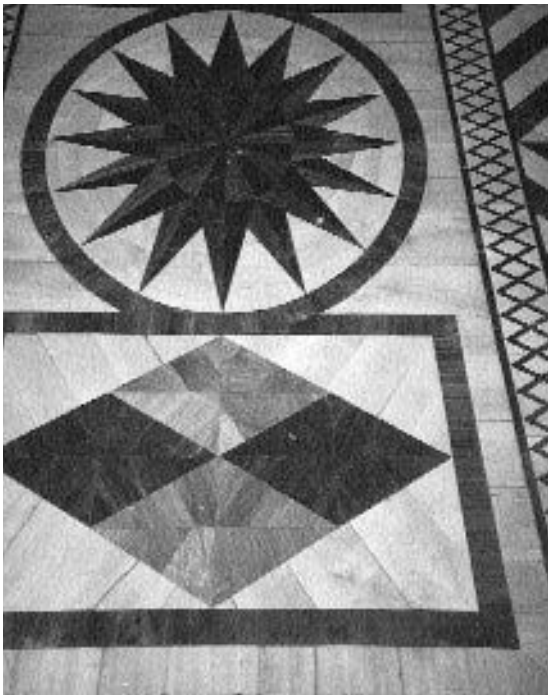


Figure 14.19 Casino, Marino, Dublin, Ireland, 1758–1776. Sir William Chambers. Marquetry floor, restored in the 1980s (Photograph, Jane Fawcett)

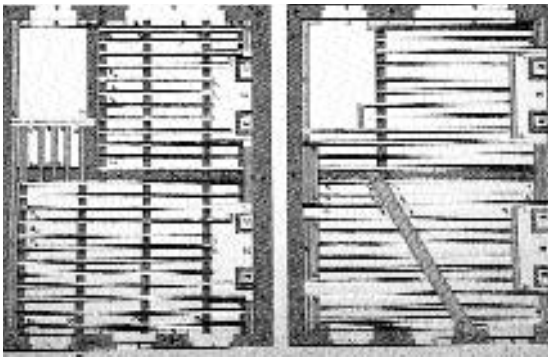


Figure 14.20 Timber floor construction from Peter Nicholson, *The New and Improved Practical Builder and Workman's Companion*, 1823

the eighteenth century, inlaid and parquetry borders were introduced. There are examples at Apsley House, in the Waterloo Gallery and in the Gallery at Attingham Park, of 1806.

Queen Charlotte visited Ham House in Petersham in 1809. In a letter she wrote that 'even under the Tattered State of Hangings and Chairs, one must admire the good Taste of our forefathers and their Magnificence. The Parquete Floors have been taken up with great Care, Cleaned and relaid, and in order to preserve them the Present Lord has put down Carpets over them, but of Course not nailed down' (Pritchard, 1995).

By the early nineteenth century complete parquetry floors were once again becoming fashionable. By 1823 Peter Nicholson wrote in *The New and Improved Practical Builder* 'the fashion for laying floors with various coloured woods, disposed in patterns, seems now to become more general in this country' (see Figure 14.20). Maria Edgeworth wrote, in 1821 'we shall leave Wycombe Abbey Wednesday Sennight . . . provided we do not . . . break our limbs . . . on these horribly slippery beautiful floors and stairs' (Parissien, 1992).

L'Art du Menuisier (Art of the Carpenter) by André Roubo was published in 1769–1775 and circulated in Germany. It contains diagrams on the layout of parquetry, including Parquet de Versailles, with a breakdown of constructional details and the tools required.

Interest in parquetry was also stimulated in Germany by the publication of *Der Bürgeliche Baumeister* (The Town Builder), 1799, by Schmidt, *Decorationen Innerer Raume* (Interior Decoration), 1834 by J.A. Roberg, and *Vorlageblatter für Maurer, Tischler und Zimmerleute* (Pattern Book for Bricklayers, Joiners and Interior Decorators), by Gustav Stier, 1827.

Some of the finest marquetry floors in Germany are in the magnificent Schloss Weissenstein near Pommersfelden (see Plate 53), the Prince-Bishop von Schönborn's residence, by Dientzenhofer. The gem-like Spiegel Kabinett of 1714 has sophisticated coloured marquetry, containing several different types of wood, including ebony. The Getäfeltes Zimmer has a boarded floor with an inlaid central motif.

The Residenz at Würzburg by Balthazar Neumann of c.1750, also built for the Prince-

Bishop von Schönborn, is a building of outstanding magnificence, now a World Heritage Site. It has, to complement its superb interiors, exceptionally ornate marquetry floors, particularly in the Grün Lackiertes-zimmer. Schloss Ellingen near Nuremberg also contains fine eighteenth-century marquetry floors (see Plate 54).

The mid-eighteenth-century Neues Schloss at Bayreuth contains a series of parquetry floors, including a variant on the Parquet de Versailles, and one based on the fictive cube design of d'Aviler, in the Palmenzimmer. The Pagoden Kabinett has an unusual floor of octagons, inlaid with small flowers. At Potsdam the Neues Palais of Frederick II contains many rooms of parquetry dating from 1767–1768, some imitating marble floors. In the Konzertzimmer the inlaid floor of 1765–1768 has a fictive cube design, embellished with a central marquetry feature. Most remarkable of all, is the Grunboisiertes Eckkabinett, with elaborate marquetry, portraying vases of flowers and leaves. Frederick II's Sans Souci Palace has similar parquetry of 1746, and the charming circular library has a radiating inlaid floor with a delicate rococo central design.

In Munich, the Residenz also contains spectacular coloured marquetry floors, restored after war damage. The Badenburg, a bathing pavilion designed for the Elector Max Emmanuel by Effner in 1718–1721, in the grounds of the Nymphenburg Palace near Munich, has a Parquet de Versailles floor to accompany the profusion of rococo decoration (Nickl, 1995).

Parquetry floors were used so widely during the eighteenth century that only a few other European examples can be mentioned. The Gold Salon by Fischer von Erlach of 1704, in Prince Eugene's Winter Palace in Vienna, has a wonderfully rich interior with gold leaf and arabesque paintings on the woodwork, and Parquet de Versailles floors. In similar style, but with more elaborate geometric parquetry, is the tea room in the Palace of Queluz, near Lisbon, Portugal of 1758. Very different in style, but again with geometric parquet floors is the Gallery of the Palazzo Doria in Rome by Gabriele Valvassori, of 1731–1734. Here the parquet provides a good foil to the gilded decoration and classical statues. The Lazienki Palace, on an island in a park in Warsaw, was originally built by Domenico Merlini and extended by King Stanislaus Poniatowski in 1772. The ballroom, beautifully restored after the war, has a splendid geometric marquetry floor of contrasted woods. Several of the other rooms have elaborate parquetry and there are also fine marble floors (see Plate 55). Wilanow Palace, also in Warsaw, was built in 1679–1731 as a royal palace for King Sobieski and contains spectacular interiors, some restored from 1955–65 after destruction during the Nazi occupation (see Plate 56). The Royal Castle, Warsaw, built 1569–1619, was razed to the ground by the Nazis. It was reconstructed after a long period of neglect, between 1971 and 1984. It contains most of the original paintings and furniture and superb marquetry floors in rooms of spectacular grandeur (see Plate 57).

The palaces of St Petersburg, Russia, many beautifully restored since the last war, are famous for their fine inlaid floors. The Peterhof is a magnificent example. One of the grandest is the Maryinsky Palace of the Grand Duchess Maria (1819–1876) built for her by her father, Czar Nicholas. The gala reception room has a superb marquetry floor composed of acanthus leaves, palmettes, chequers and a central rosette. The rotunda, the Pompeian room, the study and even the octagonal bathroom all have beautiful marquetry floors which complete these very grand Neo-classical interiors. The Summer Palace of Empress Elizabeth, and of Catherine the Great, Tsarskoe Selo, has outstanding marquetry floors, recently restored (see Plates 58 and 59).

14.6 Carpets

Floors of rammed earth, chalk or clay were used for the great halls and other ground floor rooms throughout the medieval and Tudor

period. These were often strewn with rushes or scented herbs, to sweeten the smells. Erasmus graphically described them in a letter written to Francis, Cardinal Wolsey's physician before 1530. 'The floors [of English houses] are commonly of clay strewed with rushes, under which lies unmollested [sic] an ancient collection of beer, grease, fragments, bones, spittle, excrements of dogs and cats, and everything that is nasty' (Wood, 1965). The raised dais in the great hall, or parlour, used by the family, was usually floored with wood or stone, which could be cleaned.

The first oriental carpets were probably brought to England during the Crusades. Henry III, in 1246, ordered 'mats to put upon the forms and under foot in the King's Chapel of Winchester'. Eleanor of Castile, after her marriage to Edward I in 1254, was reputed to have brought rugs for use in her apartments at Westminster. Matthew Paris, in his *Chronicles of England* (1259), reported that Spanish potentates were 'covering the very floors with expensive carpets'. Oriental carpets were brought back by the crusaders, many to be used on tables (Wood, 1965).

Cardinal Wolsey obtained carpets, described as Cairene and Damascene, from Venice in 1520, after long negotiations with the Venetian Ambassador and the Signoria. Over sixty carpets arrived via Antwerp, at a cost of 600 ducats. Wolsey used them both for tables and for floor coverings. Within eight years he was disgraced, and they were seized by the Crown. By 1547, on the death of Henry VIII, 400 Turkish carpets were recorded in the royal inventories. Some of these are illustrated in portraits of Henry VIII and Edward VI (see Figures 14.21 and 14.22). It is thought that they remained in the royal palaces until they were sold off during the Commonwealth (Gilbert *et al.*, 1987).

By the mid-sixteenth century many of the English nobility possessed 'foote carpets' of Turkish origin, to designs known as Lotto, Holbein or Ushak. The Countess of Shrewsbury at Hardwick Hall had fourteen 'Turkie' carpets, some possibly obtained by her husband William Cavendish during his travels in the east. An inventory taken at Sheffield Manor during the residence of Mary Queen of Scots included eight long 'Turkye carpetts', and two short ones, probably used for tables. By the early seventeenth century English copies of Turkish carpets were being made. Many of William Larkin's portraits show Turkish carpets. Lord Sackville, 3rd Earl of Dorset, was painted by Larkin in 1613 standing on a Lotto Turkish carpet (see Figure 14.23).

Figure 14.21 Henry VIII by Holbein, second quarter of sixteenth century, standing on a star Ushak carpet (Photograph, John Mills. By kind permission of the Board of Trustees of the National Museums and Galleries on Merseyside, Walker Art Gallery, Liverpool)

Figure 14.22 Edward VI, c.1550. Unknown artist. Stranding on a Holbein carpet (Photograph, National Portrait Gallery)

Figure 14.23 Richard Sackville, 3rd Earl of Dorset, 1613, by William Larkin, standing on a Lotto carpet (Ranger's House, Greenwich) (Photograph, English Heritage)

Persian carpets had begun to arrive by the end of Queen Elizabeth's reign. By 1618, Mytens' portrait of Lord and Lady Arundel showed a Mughal or Herat carpet, and by 1623 Van Dyck was painting the Royal family standing on Persian carpets.

Floral designs from eastern Persia replaced the medallion designs of the Turkish carpets. Some of these superb silk pile carpets from Isfahan and Kashan, with gold and silver thread, survive at Hardwick Hall, Boughton House, Knole and Hatfield House. Others, from Knole and Belvoir Castle are now in the Metropolitan Museum, New York, and the National Gallery of Art, Washington. With the formation of the Levant Company in 1580, and the East India Company in 1600, the import of Persian and Mughal carpets increased, and Smyrna merchants were busily exporting Turkish rugs to England. By the early eighteenth century the middle classes were buying oriental carpets.

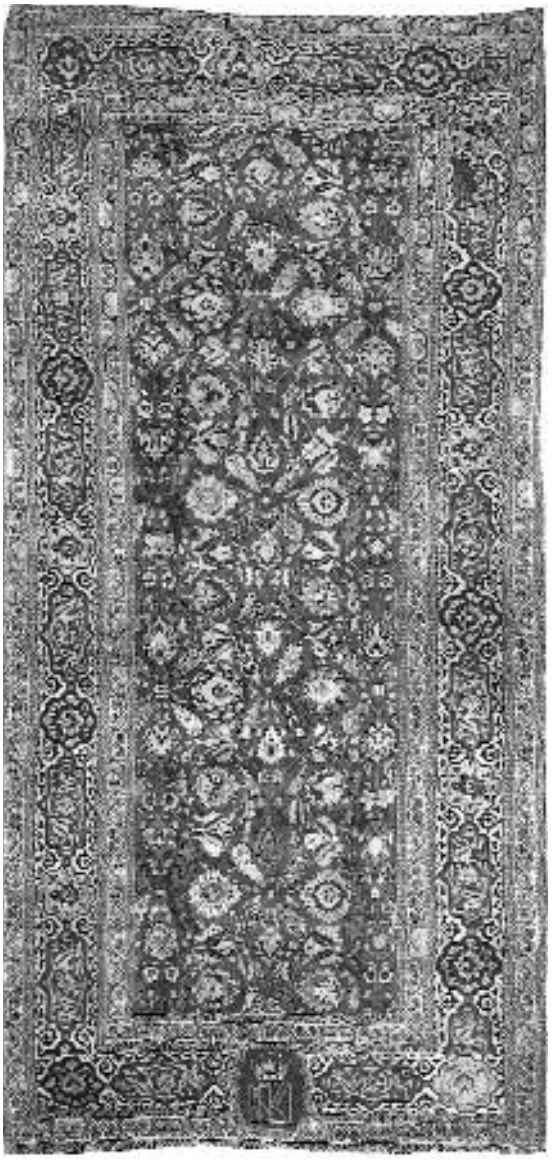


Figure 14.24 The 'Kinghorne' carpet, c.1618–1640. English make, imitating contemporary Mughal floral carpets. A rare survival. (Photograph, by kind permission of The Trustees of the National Museums of Scotland)

Several enterprising entrepreneurs imported direct from Turkey, and advertised their goods in London. The *Daily Post* of April 1724 carried an advertisement 'Imported by the last ships from Turkey, a large parcel of Turkey and Muskat carpets for Floors, Tables, Firesides etc.'. In 1740 the *Country Journal of the Craftsman* announced 'to be sold at Carpenters Hall near Little Moorgate. A . . . Parcel of Smyrna and Segiadya, and other choice Turkey Carpets . . . from six to seven yards long . . . extremely useful for Dining Rooms etc. with Hearth and Bedside Carpets of excellent Patterns and Fitness'. The word Muskat comes from Mosque while in Arabic segiadya derives from sajjada, to prostrate oneself. All these were therefore probably prayer rugs from mosques (Gilbert *et al*., 1987).

John Wood of Bath reflected this trend when he said in 1749, in his 'Essay Towards a Description of Bath' that 'as the new building advanced, carpets were introduced to cover the floors'. The use of oriental carpets in the early eighteenth century was illustrated in contemporary conversation pieces. Hogarth in 'An Assembly at Wanstead 1731', Zoffany's portrait of Sir Lawrence Dundas and his family, 1769, and of Lord Willoughby de Broke and his family, 1770, show grand Turkish carpets and rugs in strong blues and reds with palmette or floral designs. By the 1770s a Turkey carpet was considered de rigueur in polite society.

As the century progressed the production of manufactured Brussels, Wilton and Kidderminster carpets, made to measure and covering the entire room, took over from the oriental hand-worked carpets. From 1761 until the end of the century Moorfields and Axminster engaged the entire market for knotted carpets in Britain. Horace Walpole, in 1765, paid £87 for a knotted carpet in Gothic style for Strawberry Hill (Thornton, 1984).

Thomas Moore of Moorfields won, in 1757, an award from the Society of Arts for a carpet 'in many respects equal, and in some respects, superior to those imported from Persia and Turkey'. He provided carpets for Robert Adam at Croome Court (1768), Syon (1769), Osterley Park (c.1773), and 20 St James's Square (1774) to a design by Antonio Zucchi, for the Williams-Wynn family (Beard, 1981).

Robert Adam recognized the importance of floor treatment to co-ordinate his classical interiors. The halls contained marble

pavements, while for the main rooms he designed superb carpets, often laid to expose a border of parquet on which the furniture could be placed, coinciding with the fashion for placing furniture against the walls. He produced superb carpets for at least twelve country houses and eleven London houses. Those at Syon, Harewood House, Osterley Park, Newby Hall and Saltram survive.

The development of Adam's carpet designs follows the general trend of his architectural style. The bold florid ornament for Kedleston moved towards the more delicate two-dimensional treatment of his later years. One of the earliest to recognize his talents was Lord Coventry, for whom Adam worked at Croome Court, Worcestershire, from 1760 until 1781. He designed several carpets, made by Moore in 1768, none of which has survived. A surprising chinoiserie ceiling, with a spectacular carpet decorated with four small oval Chinese scenes, were designed by Adam for Mrs Montagu's drawing room in her house in Hill Street, c.1766. This is an example of Adam's skill in drawing the different components in a room into a stylistic relationship, with dramatic colour contrasts between the bold lapis blue and Chinese yellow and Pompeian red of the carpet, and the muted yellow, white and ochre of the ceiling.

Adam also designed a fine architectural carpet for the music room at Harewood House, 1765–1771, where 'Edwin Lascelles, after work on decorating the house had begun, bought yellow silk for the walls, and Adam was obliged to change his colour scheme for the ceiling'. In September 1769, painting a specimen of colours for Mr Adam's approbation is mentioned. The colouring of the carpet, as originally designed by Adam was of soft pinks and browns, and presumably the walls and ceiling would have been similar. The ceiling paintings are by Biagio Rebecca, and the chimney piece lyre motif is reflected in the carpet design (Beard, 1981).

Adam's floors at Syon are outstanding. The dining room carpet, the design based on Roman pavements, was made by Thomas Moore, signed and dated 1769. It was intended for this strictly classical room, and repeated the delicate ceiling pattern. It was later moved to the red drawing room, where it no longer suits the character of the room, with its coved ceiling and walls hung with red damask. The long gallery, converted from the Jacobean gallery in 1764 was, according to Sir John Summerson, the place where the Adam style was born. Adam said of this room that it 'was finished in a style to afford great variety and amusement'. His carpet completed a brilliant composition, with plasterwork by Joseph Rose and furniture, much of it still there, also designed for the room. It is sad that the original carpet has gone.

At Saltram, Devon, the drawing room was designed by Adam in 1768–1769, and the Axminster carpet made by Thomas Whitty was delivered in 1770 (see Plate 60). The ceiling contains roundels by Antonio Zucchi, surrounded by intricate plasterwork, reflected in the carpet design.

At Osterley Park, Adam's carpet for the drawing room copies the sunburst ceiling adapted from a drawing of Palmyra, published by Robert Wood in 1753. The tapestry room with its sumptuous Gobelin tapestries to designs by Boucher has a related carpet, designed in 1775 and made by Thomas Moore. The carpet repeats the ceiling medallions, and also contains copies of the flower vases from the tapestries. The furniture was also designed by Adam. Both carpets are still in situ.

Adam worked at Culzean Castle, Ayrshire, for the Earl of Cassilis from 1777. The circular first-floor saloon (see Plate 61) contains a range of windows overlooking the sea, with views of the mountains of Arran beyond. This is one of Adam's finest rooms, for which he designed a spectacular carpet in 1790, made by Moore. Zucchi is said to have provided Moore with a pattern of the ceiling to copy for the carpet design (Beard, 1981). The original is now in store, but has been replaced by a copy.

After Adam, there are few examples of architect-designed carpets. James Wyatt

supplied a design for Sir Thomas Egerton of Heaton Hall for his first-floor room, decorated with grotesques and Etruscan ornament. He also designed a carpet for the boudoir at Belton, Lincolnshire, to correspond with the ceiling (see Plate 63).

Samuel Wyatt designed the knotted pile carpet supplied by Axminster for the Peter the Great room at Blickling in 1780, also linked to the ceiling design. At Tatton Park Wyatt designed a carpet for the library in 1806. The carpet, recorded in a watercolour by Buckler of 1820, included the signs of the zodiac.

Two years later Sir John Soane designed a Grecian interior for the drawing room at Taymouth, Perthshire, including a carpet which complemented the ceiling design with its three roundels. It is sad that it was never carried out. The flamboyant Gothic Revival interiors carried out for Queen Victoria's visit in 1842, by Gillespie Graham and Crace, were of a very different character.

By the early nineteenth century close-fitted Wilton and Brussels carpets, often of floral designs, had become relatively cheap and popular. They were machine woven, cut in strips, with borders that could be added. The Prince Regent ordered carpets for both Carlton House and the Brighton Pavilion. At Carlton House the floors were close covered with a brilliant blue carpet, scattered with golden fleurs-de-lys. In 1785 he had a magnificent Persian carpet made in imitation of marble for Carlton House, illustrated in Pyne's *Royal Residences* (1819).

At Ickworth the 1st Marquis of Bristol laid Wilton floral carpets in the library and drawing room in the 1820s. One of the largest and most comprehensive schemes was for fitted carpets to all the principal rooms in Pordon's Eaton Hall, Cheshire, carried out by Gillows in the early nineteenth century for the Duke of Westminster (Fowler and Cornforth, 1974).

J.C. Loudon in his *Encyclopaedia of Cottage, Farm and Villa Architecture and Furniture* (1833) stipulated for the saloon, that 'modern ideas of comfort make a carpet and curtains indispensable. The carpet should be of thin material, covering a great part of the room, but showing about a yard all round it of polished oak boards. It should of course be a bordered carpet; the colour of the ground a shade of fawn; the pattern chiefly shades of crimson'. In the library he recommended 'a large Turkey carpet, or an Axminster carpet, with a maroon coloured ground'.

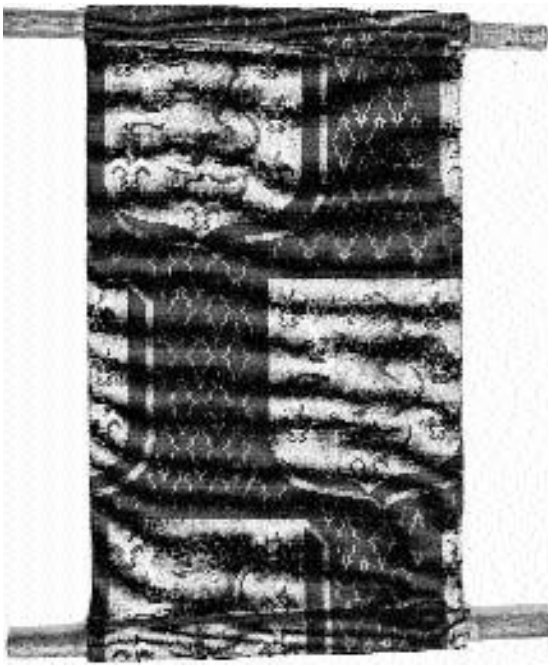


Figure 14.25 Carlton Towers, Yorkshire. Brussels carpet, 1844. Beaumont heraldic shields on a purple ground with red lozenges (Photograph, Temple Newsam)

There is evidence that Augustus Welby Pugin designed carpets for Lismore Castle, Co. Waterford, on which he worked with Crace in 1850 for the 6th Duke of Devonshire, and for the Palace of Westminster. He said to Crace, after working on wallpaper patterns 'we must have a turn at carpets next. Let us reform them altogether'. He sent Crace some carpet designs in 1848, one of them a bold design for the Palace of Westminster (Aldrich, 1990).

The carpets for Buckingham Palace, Windsor Castle, Osborne House and Balmoral

are illustrated in Queen Victoria's Souvenir Albums. At Balmoral, several of the rooms, including Queen Victoria's bedroom, dressing room and drawing room had tartan carpets. In 1844 Lord Beaumont of Carlton Towers, recently ennobled, covered his library floor with a Brussels carpet in crimson with blue shields each containing a fleur-de-lys and a lion rampart (his crest). It is still there today (Figure 14.25). Heraldic carpets were popular in the mid-nineteenth century for families with antiquarian interests, such as the Fairfax-Lucys at Charlecote (Gilbert *et al*., 1987).

By the 1870s *Beeton's Housewife's Treasury* advised against comfortable close-carpeting of rooms, and said that 'The old style is now giving place to the far more healthy and cleanly mode of laying down a square of carpet in the centre of the room'. This heralded the return to fashion of the oriental rug.

Contemporary with Mrs Beeton was William Morris who also believed in plain floors with rugs, many of which were designed for him by J.H. Earle. A fine surviving example is at Standen, East Grinstead, by Philip Webb of 1894. Although the flowered drawing room carpet is not original to the house, nonetheless it completes an important Arts and Crafts interior and is one of the best surviving Morris carpets. It was designed by J.H. Earle at Merton Abbey for Morris.

14.7 Floor cloths

The use of painted canvas floor cloths was first recorded in the early eighteenth century. They offered a cheap substitute for carpets or marble pavements. Although few examples have survived, they were very popular, particularly in entrance halls, where they were painted to resemble marble pavements. They were also used in passages, on stairs and round sideboards, to protect the floors from staining. As they were made from wide seamless sheets of canvas, the manufacturers often established themselves in ports, where large looms, used for weaving sails, were available. Nairns of Kirkcaldy, Hare of Bristol, Nathan Smith of Knightsbridge, London are recorded as suppliers. The canvas was stretched on a frame, and then painted on both sides with up to twelve coats of paint mixed with linseed oil, each laid on with a trowel. Finally the designs were stencilled, or hand painted. The finished cloths, which took several months to dry, were extremely heavy, weighing as much as 4½ pounds a square yard.

Pattern books were produced, to advertise the variety of designs available, some of which have survived. Robert Barnes's scrapbook of the 1850s contained an account of his family business, in Moorfields, London, and a range of colours and patterns. John Carwitham's designs, although intended for stone and marble pavements, were also adapted for painted floor cloths.

At Attingham Park, Shropshire, a floor cloth in the library is recorded in the sale catalogue of 1827, a 'handsome slate and stone colour octagon-panel roset-pattern Floor-Cloth to close fit room round carpet'. The dining room contained 'Turkey-pattern Floor-Cloth'. At Harewood House the painting of oil cloths for the sideboard area in the dining room was recorded by Chippendale in 1771, while in 1818 Sir Walter Scott was given an oil cloth to protect the floor under his sideboard (Gilbert *et al.*, 1987).

By the early nineteenth century, when block printing was developed, Roman mosaics could be reproduced, and some of the recently excavated pavements were copied. Hare and Co. of Bristol exhibited a floor cloth reproducing one of the Woodchester Roman pavements, excavated in 1849, at the Great Exhibition in 1851. Three rare examples survive at Calke Abbey, one of which is based on William Fowler's engraving of the Roman pavement at Storton, Lincolnshire.

Floor cloths were widely used in America in the eighteenth and nineteenth centuries, and are well documented. Two fragments survive

in the Winterthur Museum (Fowler and Cornforth, 1974).

Linoleum, patented by F. Walton in 1860, was found to be more durable, cheaper and easier to manufacture, and rapidly took over the market.

14.8 Ingrain carpets

These reversible carpets, woven without pile, were usually referred to as Scotch or Kidderminster carpets. They were also made in the woollen districts of Yorkshire and Lancashire. Ingrain carpets originated in the eighteenth century as a home cottage industry. However, the fashion spread, and by the late eighteenth century Kidderminster had 200 looms manufacturing flat patterned carpets. The carpets were reversible, cheap and hardwearing. In Scotland the centre of carpet manufacture was, by the late eighteenth century, in Kilmarnock. Ingrain carpets were also made in Stirling, Glasgow, Kelso and Hawick. Their use in country houses both north and south of the border, in the late eighteenth and early nineteenth century, was widespread, although there is little documentary evidence.

14.9 Matting

The use of rush matting in country houses from the Elizabethan period until this century is well recorded and illustrated in many Tudor and Stuart portraits. After the Restoration in 1660 imported rush mats, often woven with patterns, became popular and were known as Africa, Barbary or Portugal mats. They were generally used in halls and passages. Their use is recorded at Hampton Court, Windsor Castle and Kensington Palace. Matting was used in the Regency period, and during the late Victorian and Edwardian era when cheap Oriental matting flooded the European market (Gilbert *et al.*,1987).

14.10 Painted floors

Although the painting of floors was well documented from the seventeenth century onwards, very few have survived. It has been suggested that the brief fashion for painted floors to simulate marquetry may have come from Holland, where many of the English aristocracy were exiled during the Commonwealth. At Crowcombe Court, Somerset, the dining room floor was painted in c.1760 with a border foliage design with the Carew arms in the centre. At Belton House, Lincolnshire (see Plate 62), the Tyrconnel Room has a design of anthemion motifs, with the Brownlow arms in a central roundel, in black, brown and red. It may date from the building of the house in 1685 (Thornton, 1978). Hanbury Hall, Worcestershire, also contains two painted borders, one in the drawing room and another in an upper room.

An interesting painted mosaic pavement was designed by John Yenn in 1792 for the guard chamber floor at Windsor Castle. The design was partly derived from the Roman pavement excavated at Saintsfield near Woodstock (Gilbert *et al.*, 1987).

Painted floors in Scotland were more common than in England. Ian Gow (Gow, 1981) records the existence of painted floors in Edinburgh's New Town, where both stencilled and painted floors have been discovered recently, at 28 Marlborough Street, Portobello (1823) and at 3 Mansfield Place, an elaborate stencilled design in a bold red and ochre painted fret design.

Flagged stone hall floors were painted to resemble black and white marble, in Edinburgh, at Balfour Castle in Orkney, and at Abbotsford, for Sir Walter Scott.

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15

The conservation of the excavated floor

Daryl Fowler

This chapter will concentrate on the issues involved in the conservation of historic floors exposed as a result of excavation, usually within an archaeological context. Many of the issues and techniques involved will be familiar from other areas in the care of historic buildings and monuments although, as is frequently the case in conservation, the application may be slightly different from that originally intended.

15.1 Preplanning

Archaeological excavations, either within buildings or on open sites, like all aspects of the care of built cultural heritage, require careful preplanning. Normally the archaeologist knows what he expects to find. However, in the past the archaeologist was less concerned with the long-term care or preservation of the site once he had removed the intellectual information and the portable finds from it. The Mediterranean and Near East is littered with archaeological sites where no consideration has been given to the problems of long-term preservation of the exposed remains.

15.2 Recording

Elsewhere in this volume are contributions on the various techniques of recording floors. But the key aspect is to understand *why* they are being recorded. There are three key reasons to record, each one requiring a different sort of record.

(1) During excavation the archaeologist will be concerned with physical form, decoration, style, and the stratigraphic relationship of the floor with the rest of the site.
(2) For conservation. The conservator will be concerned with the physical condition of the floor and its component parts, the decay cycles it will be subjected to, the need to record any intervention, the creation of a sustainable environment, and any modern intervention in the historic material.
(3) For maintenance. The maintenance of an excavated floor will need a record that combines that of the archaeologist and that of the conservator. It will often be critically important to monitor any change to the condition of the floor or the surrounding environment. This can often only be done from the basis of sound documentation.

15.3 Key decisions

Having located or exposed the floor the archaeologist will have obtained the necessary

information from it and the surrounding layers. There is then a need to make the key decisions:

(1) Should it be retained either on a temporary basis or as a more permanent measure?
(2) Should it be preserved in situ, and if so what are the necessary environmental conditions?
(3) Should it be preserved somewhere else other than in situ?
(4) Does it need to be removed, to enable the excavation to continue, or for other reasons?

15.4 Threats

Having made these decisions it is necessary to examine the implications and, in particular, the variety of threats to which the floor is now exposed.

It is possible to identify the main areas of risk and produce an analysis of the risks to each area:

chemical destabilization
biological attack
animal damage
climatic exposure
vandalism
theft

Under normal circumstances the most successful approach to a conservation problem is likely to be ensuring a regime of environmental mitigation.

15.5 Long-term exposure

If a floor is to be exposed for a long period of time then some sort of protection is essential. Shelters come in various shapes and sizes. At their simplest they can be just an agricultural cover building. At the other end of the scale they can become substantial pieces of architecture often rivalling the remains for the visitor's attention.

The most critical factor with a cover building is to understand that it will alter the local movement of moisture across a site, not always for the long-term good of the floor. There have been a number of published studies on cover buildings, but these all need to be applied to individual sites with great care! (Agnew and Coffman) Rainwater disposal and the interface with groundwater movement are critical. Even when a modern building completely spans a site the historic, unlifted floor which it is trying to protect may be the only area left inside able to respond to varying climatic conditions which will inevitably result in increased moisture movement and subsequent decay.

Around pavement areas modern drains can be installed incorporating various techniques to allow the ground moisture to evaporate. But these must all be tempered with a sensitive analysis of site conditions.

Frequently temporary shelters are essential, for protection in wintertime when it may be vital to keep the frost out of the ground. In fact, often the best way to protect, even in the short term, is to rebury. However, even here a decision is not straightforward, as explained later in this chapter.

The presentation and interpretation can only be considered on a site-by-site analysis. The guidance that can be given within this short chapter must be kept to basic principles.

As a general rule it is *essential to keep the public off the floor* at all times. Even maintenance staff need to have an established routine and method of access to ensure that foot damage is avoided.

There is often a desire to display a particular floor by the application of a surface finish that allows colours to be better appreciated. All we can do is counsel caution. Is the product reversible? Is the action really necessary? Has it been done anywhere else? A general rule of thumb is not to do it and not to believe sales literature. **Most conservation disasters have involved the use of modern, often untested, materials.**

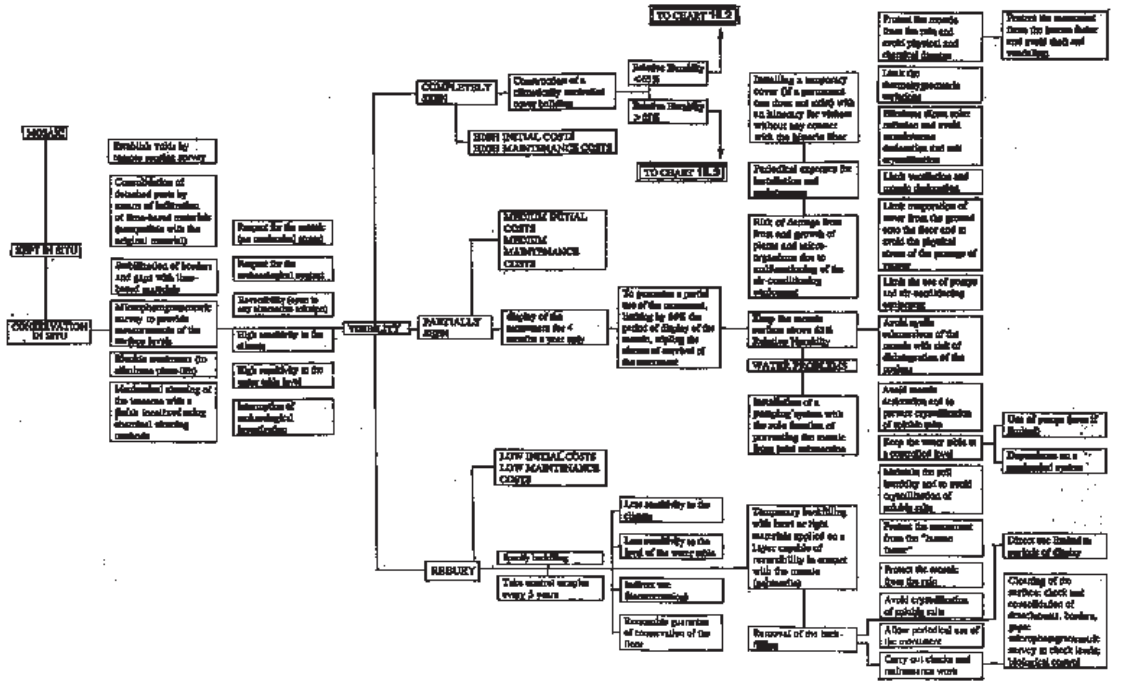

Chart 15.1 Introductory design matrix (based on a design matrix by Roberto Nardi)

A proper maintenance routine is essential for the long-term well-being of a floor, excavated or modern. The excavated floor by its very nature is likely to be more fragile, so the maintenance specification must start with the operatives themselves. How do they obtain access to the floors? What footwear is appropriate? What cleaning methods are acceptable or unacceptable? These need to be specified. In some cases recording or re-recording a floor may become an essential part of a maintenance plan and needs to be done on a regular basis.

15.6 Lifting floors

The techniques used to lift floors will vary depending on the size of pieces and the area involved. First of all it is necessary to question the intention of lifting the floor. Stone and clay tiles can be dealt with by careful record drawings and subsequent packing and numbering of the pieces, followed by later relaying. It must be remembered in relaying that the width of the joints will be critical to avoid the overall dimensions of the floor expanding or contracting, especially if a design is to fit back into an existing space. With this situation it is often best to reset the floor and lay key parts of the design first and then infill the plain panels.

15.6.1 Mosaics

Major issues need to be considered with the lifting of mosaics. There are museum stores all over the western world with pieces of mosaic floor. These are either large, buckling and almost impossible to move, or in some cases decaying heaps of loose tesserae that have become detached from their 'temporary support'. Before lifting a mosaic it is critical to establish what will happen to it next: where and what are the storage conditions? Loss in store is not uncommon, especially with the failure of animal glues. Charts 15.1 to 15.3

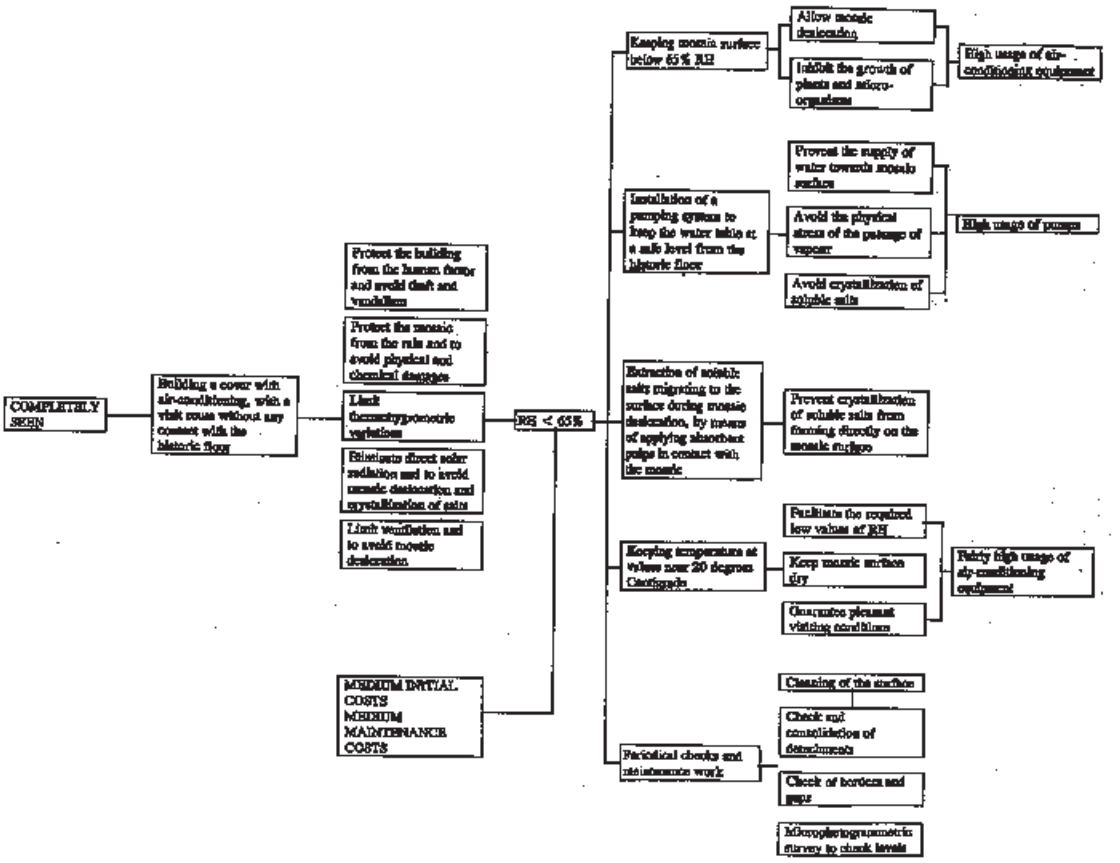

Chart 15.2 Design matrix for environments below 65% RH (based on a design matrix by Roberto Nardi)

show the main areas of concern for the treatment of mosaic floors. These are based on previously published papers of Roberto Nardi but have been expanded slightly.

If lifting is accepted then it is necessary to decide if the mosaic is to be lifted in one piece or cut up into panels. Often the site constraints will dictate this. Rolling and single-sheet lifting of mosaics requires good access for heavy equipment and unrestricted access to the edges of the mosaic. Lifting in small areas assumes that the panel or design can be subdivided into sensible units. In the past the decorative borders and emblemata of mosaics were the only pieces kept, but today the amount lifted probably would be a reflection of how well the excavation was funded.

Before lifting it is essential to record and examine the mosaic accurately. It is then consolidated as necessary to withstand the strain of lifting. Local conservation issues of individual tesserae must be dealt with. The faces are then covered with a protective surface. This is often initially done with Japanese tissue set in Paraloid B72 in Chlorothene, loose tesserae being reset in a weak mortar (such as one part lime to four parts stone dust). The whole is then surfaced with two layers of cotton gauze or hemp cloth with suitable tails left for fixing to the rollers. It is essential that the cloth is first washed, ironed, and edged to ensure it lies flat and true without crinkles.

A timber drum or roller is made, on which the mosaic is to be rolled. This is usually

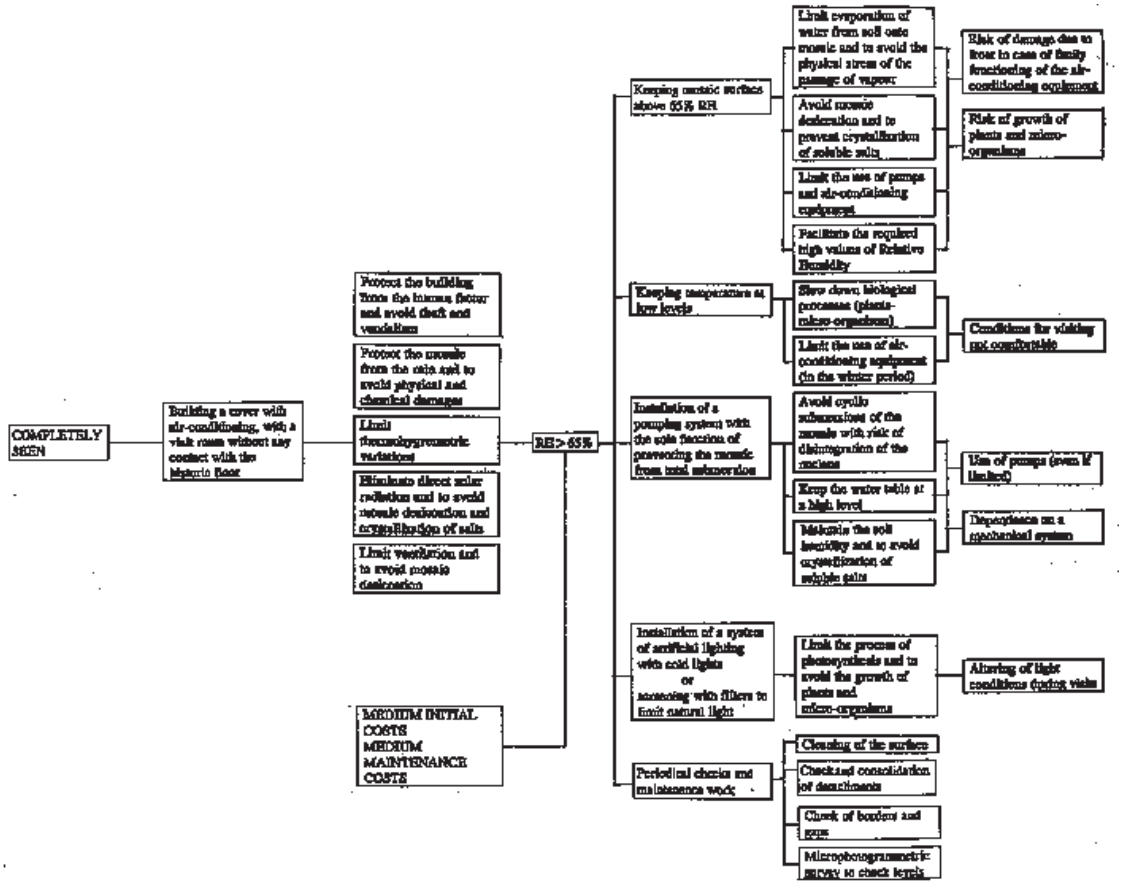

Chart 15.3 Design matrix for environments above 65% RH (based on a design matrix by Roberto Nardi)

purpose-made with guide rails set up along the edge of the mosaic. Using levers in holes in the edge of the drum, the mosaic can now be carefully undercut and, supported by the facing, the whole top surface can be rolled on to the drum. It should be noted that the mosaic itself, without the drum, is likely to weigh *in excess* of 250 kg/m^2. Heavy lifting gear will be essential to transfer the drum and rolled mosaic. Before starting it is important to have planned the full programme of work to the floor, including its final resting place. In the past the mosaic would have been rolled out on to a bed of concrete and brick aggregate in a museum, the result being an immovable panel of great weight and with the concrete possibly contributing to the long-term decay problem of the mosaic.

There are now various, currently fashionable, techniques for the consolidation of the rear of mosaic panels. It is important to stress that it is very much a question of fashion and available materials. Perhaps the most successful technique involves the new generation of lightweight panels of aluminium honeycomb (Aero web) surrounded by a plastic skin and reinforced with glass fibre. These are set in aluminium T frames to form the basis of the new mounting system.

First the mortar needs to be cleaned off the rear of the mosaic, so it must be unrolled face down onto a separating medium between the mosaic and a prepared, level slab (such as 1000-gauge polythene sheet). Then after mechanical cleaning a new backing mortar can

be applied. Once this is set it can be ground down to form a thin flexible layer, capable of being re-rolled without mechanical failure. The mosaic on its new support could then be re-laid back at the original site, as was carried out at the Paphos excavation in Cyprus by the Getty team.[1]

15.7 Earth floors

For the vast majority of buildings the rammed earth floor was the most common. The mix will have varied from a chalk or soft limestone mix pounded into a clay-based floor that effectively sets. Once dry and with a suitable mix this would have given years of wear. The survival of these floors within the archaeological record is good, although once exposed they are quite fragile. They are frequently found both inside and outside extant buildings.

In order to preserve the original floor it is critical to keep people off the surface. However, in many situations the concept of the earth floor is more important than the original material, and so maintenance is required to make up losses and decayed areas. In some cases excavators have decided to replicate the floor, such as at the medieval town house in French Street, Southampton. Here an earth–lime mix was laid in the building and allowed to dry out naturally. It was protected from the subsequent building work on the monument and became too dry and dusty on the top surface; however, a light watering helped the lime to reactivate. Rising damp is probably an essential ingredient in a good earth floor and the restoration of the medieval undercroft at French Street had kept the floor too dry to ensure its full integrity.

At Fountains Abbey the twelfth-century earth floor of the west claustral range is still regularly walked upon, and the maintenance regime is largely filling up holes and depressions – themselves mainly the results of poor backfilling after archaeological investigations. The surface is a hard mixture of clay-based soil and lime. Elsewhere at Fountains Abbey the earth originally had a thin plaster skin to give a more attractive surface, although this was obviously more vulnerable to wear.

15.8 Paved floors – stone

The excavated stone floor is usually a durable hardwearing surface, whether stone flags or pitched cobbles. However, it is rare that a complete area of surface is available with a sufficiently complete integrity to reuse it without repairs if the surface is to be walked upon. This raises all the normal issues related to stone repairs and matching old and new surfaces; decisions which I believe are best tackled site by site. In some places it is the cultural significance of the paving that matters. For example, at the Via Dolorosa in Jerusalem the exposure of the Roman street pavement on which Christ may have trod is emotive to today's pilgrim.

Preservation issues are closely related to visitor erosion, moisture movement or vegetation. The stone flags, once exposed by excavation, will no longer be in a 'stable' environment. The top surface of porous slabs will suffer from salt crystallization. The slight difference in moisture levels may well encourage biological growth, producing green algae and more sophisticated plant growth in extreme conditions. Keeping visitors off the historic floor is a common theme throughout this volume, but in some cases this may be impractical. The edge to the pool of the Roman Temple of Aqua Sulis at Bath is an example of the balance required between visitor access and conservation management.

15.9 Fired clay

Excavated clay-tile floors feature elsewhere in this book. The physical problem of their

[1] Conservation of the Orpheus Mosaic at Paphos, Cyprus, GC1.

conservation has much to do with the moisture movement pattern and the thermal stresses they will be subjected to, as well as physical wear. Even very subtle changes may be sufficient to tip a stable environmental condition into a destructive one. A spotlight 2 or 3 m away from a tile surface can, in extreme conditions, cause the crystallization of soluble salts in the surface of the tiles and their subsequent destruction.

15.10 Materials for maintenance and repair

Throughout this chapter reference has been made to the need for maintenance of the excavated floor. It is vitally important for the well-being of the floor, **not to use Portland cement for patch repairs**. In some circumstances concrete under slabs may be necessary to provide support, but this needs to be done in the clear understanding that the Portland cement is unlikely to be incompatible with the historic floor material. Joints and edges are critical for the long-term welfare of the floor no matter of what material the floor is made. It is here that the breakdown of the key occurs and the decay processes start.

15.11 Backfilling

Frequently the best decision is to rebury the excavated floor, either as a temporary measure whilst a conservation strategy is worked out, or as a more permanent solution for long-term preservation. Some research has been undertaken on preservation by backfilling by English Heritage (English Heritage Conservation Bulletin, October 1989) and the Getty Conservation Institute (Corfield, forthcoming)

In many ways the decision to leave a floor where it is raises more complex preservation issues than lifting it. Although low in capital costs the long-term monitoring of a backfilled site is important if the well-being of the floor is critical.

Normally when a site is backfilled the soil is put back with little consideration for any other matters, except perhaps for long-term settlement and compaction. This method will, however, promote an aerated fill which will encourage plant growth and subsequent root damage. The reduced insulation of the loose soil would also expose the floor to greater thermal stresses, more equivalent to leaving the floor exposed.

So the backfill needs to be specifically designed to carry out its task of protection. Consideration would need to be given to: the physical properties of the backfill; the chemical properties of the backfill; the morphological characteristics; the mineralogical content and its stability; and the biological and organic content of the soil. All of these factors will contribute to the performance of the overburden. It must never be forgotten that the ability of an historic structure to 'breathe' is equally essential for the buried floor. The requirement to transport groundwater and water vapour upwards to the surface is important. It may be necessary to create drainage layers of loose gravel such as the construction of land drains to remove excess or unwanted groundwater. Man-made materials must be examined very critically. Will anything leach out that could be deposited on the buried floor? Plastic sheeting has often been used as a marker horizon but many types of sheet are quite unsuitable. Other factors that need to be considered would include weight, erosion resistance, organic and inorganic contamination. But it should be recognized that a perfect material is unlikely to be immediately to hand, so informed compromises might have to be made.

The Getty Conservation Institute has been examining these issues; the conclusion of their research has stressed the need for an intimate contact between the floor surface and the fill so that no air pockets are created that would encourage salt crystallization. Geotextile sheets offer some potential to structure backfills, but they must be selected with care (Podnery *et al.*, 1993).

Monitoring the condition of the floor can be done by physical examination at a regular preset interval, say every year or every five years. This could be complemented with remote monitoring of subsoil condition. This is a very complex subject. In the city of York, it has been noted that since the construction of a concrete slab on one site during the 1960s the buried historic ground surface has actually dropped by 300 mm during the intervening thirty years. This was probably due to the complex change within the subsoil hydrology in the city. Indeed in a waterlogged subsoil the chemistry of the water has a critical effect on the preservation of the archaeological record. There is still a great deal of work to be done on the whole subject of backfilling and monitoring of archaeological levels. As archaeological investigating becomes more sophisticated, in situ preservation and non-destructive monitoring will undoubtedly become more important in the future.

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16

Seventeenth-century and later floors at Ham House

Christopher Rowell

Ham House, Richmond, is one of the best preserved, and certainly one of the best documented seventeenth-century houses in Europe.[1] In several rooms the panelling retains its original wood graining in *trompe l'oeil*, Parisian furniture of the 1670s still stands in the positions recorded at the time, paintings in frames as early as c.1630 hang in the rooms for which they were acquired. Most remarkable are the silk-damask-embroidered wall-hangings, faded but corresponding exactly to their detailed descriptions in the seventeenth-century inventories. Ham was already redolent of another age when Horace Walpole described its furniture in 1770 as 'magnificently ancient, dreary and decayed' within a house 'so blocked up and barricaded with walls, vast trees and gates, that you think of yourself an hundred miles off and an hundred years back' (Walpole, 1927–1928).

Despite the longevity of its reputation as an unaltered seventeenth-century *locus classicus*, Ham has not been immune from later alterations. Its subsequent owners may have been more antiquarian than their peers, but this did not prevent them from bringing their house up to date. The three main periods of alteration were in the 1730s and 1740s, about 1800, and in the late 1880s and 1890s, by the 4th, 6th and 9th Earls of Dysart. Recent research has illuminated their contributions, and has revealed that at Ham the seventeenth century cannot be fully understood in isolation, but must be considered in relation to what came afterwards. This is certainly true of the floors, of both wood and marble, which have been altered (not surprisingly) to a far greater extent than any other element of the woodwork. Thus, while the panelled and carved woodwork provided by the craftsmen named in the accounts of the 1630s, 1670s and 1680s[2] still survives intact, much of the flooring has undergone considerable alterations, initially in the mid-eighteenth century, but most radically in the late nineteenth century. The National Trust's refurbishment of Ham, begun in 1990 when the Victoria & Albert Museum relinquished its lease, has revealed much about this process, and has provided opportunities to undertake repairs, to improve the appearance of the floors and to bring seventeenth-century parquetry out of store and to replace it in its original position.

Ham House was built in c.1610, and was the home from 1626 of William Murray

[1] For the most recent general account of Ham House, its architecture, collection, garden and family history, see Moore *et al.* (1995).

[2] The seventeenth-century Tollemache and Lauderdale accounts are published with a commentary in Thornton and Tomlin, 1980a.

(c.1600–1655)[3] a close friend of Charles I, who created him 1st Earl of Dysart in 1643. Like the King, Murray was a connoisseur and collector who, between c.1637 and 1639, employed royal craftsmen to create a first-floor state apartment reached by an elaborately carved staircase. This was probably under the direction of Franz Cleyn (1582–1658), a German, who had previously worked for the Danish Court. Cleyn worked under Inigo Jones, Surveyor of the King's Works, on the royal palaces, and Jones may have been the *éminence grise* behind the Ham improvements, which reflect the influence of Italian and French design constituting a rare survival of Jones's court style. The wooden floors of Murray's state apartment: the Hall Gallery (then the Dining Room), North Drawing Room, Long Gallery and Green Closet, were first altered later in the seventeenth century, and were subsequently almost completely replaced in the late nineteenth century. The plain boards of the Great Staircase must be almost entirely nineteenth-century replacements, given that the staircase was extensively restored, either at the beginning of the nineteenth century by the 6th Earl of Dysart, or at the end by the 9th Earl. The only floor that definitely survives from the early seventeenth century is that of the Great Hall.[4] A mason's bill of 1672 mentions 'mending ye old paving in ye old Hall', and therefore the black and white chequered marble floor must date either from c.1610, when Sir Thomas Vavasour built the house, or from the late 1630s when his successor, William Murray, was engaged in his remodelling. At this time, the dais at the east end was created when the Great Hall (see Plate 64) was extended and a round-headed arch was constructed to lead into the Great Staircase. The marquetry and parquetry dais floor of walnut and cedar,[5] which must always have sat rather oddly with the black and white marble floor of the Hall proper, was clearly designed to link with the wooden floor beyond the arch, and acts as a prelude to the elaborate, if somewhat crude, carving of martial trophies on the staircase balustrade. Its geometrical design indicates that it was laid during the Duke and Duchess of Lauderdale's major campaign of interior redecoration in the 1670s and early 1680s when the Great Hall may have been repanelled, and the Great Staircase was redecorated. The dais floor was taken up and put into store some time before 1954, and has recently been relaid by Mr John Hart, the Trust's local adviser on furniture conservation, who also carefully replaced the missing sections (about 30 per cent) in the appropriate woods, toned to match the well-preserved original parquetry. The repaired floors of the Inner Hall and Staircase now correspond to the colour of the dais, having been divested of thick layers of modern polish by Mr Hart.

All the floors of Murray's first-floor rooms (i.e. between the Staircase and the Long Gallery) were renewed in the 1890s by the 9th Earl of Dysart. Their oak parquetry, of geometric design, is copied from the surviving floor of 1673 in the Queen's Bedchamber, then the climax of the State Apartment, which was extended by the Duke and Duchess of Lauderdale after their marriage in 1672. The Duchess, Countess of Dysart in her own right, was the daughter and heiress of William Murray. Beautiful, intelligent and extravagant, her marriage to the Duke gave her the means to aggrandize her family home with royal splendour. John Evelyn described Ham in 1678 as 'furnish'd like a Great Prince's' and 'inferior to few of the best Villas in Italy itself'. The

[3] For William Murray as patron and collector, see Thornton and Tomlin, 1980b and Rowell, 1996.

[4] Bill presented by the mason, John Lampen, in 1672 (Buckminster Mss; quoted in Thornton and Tomlin, 1980a, note 3, p. 38). Lampen also laid the matching marble floor of the Marble Dining Room (replaced by parquet in about 1756) and the existing black and white marble flooring in the Chapel.

[5] For a detailed analysis of the woods used in this floor and in the Marble Dining Room, see the report by Rowena Gale in the National Trust's archive at Polesden Lacey, Surrey (unpublished).

Figure 16.1 A French Bedchamber of the 1680s, engraving by J.D. de St Jean (Bibliothèque Nationale, Paris). The parquet floor is identical in pattern to the floors of the Queen's Apartment laid by Henry Harlow in 1673 (Copyright, Bibliothèque Nationale)

Queen's Bedchamber was completed in 1673 for a state visit by Queen Catherine of Braganza. The room is still named after her, despite being converted into a drawing room in c.1744 by the 4th Earl of Dysart. For this purpose, the four-inch high dais for the state bed was an inconvenience, but despite being relaid at the same level as the rest of the floor, its superb marquetry was retained (see Plate 65). The resulting asymmetry of the drawing room floor, with marquetry at one end only, clearly mattered less to the 4th Earl than the preservation of one of the two finest floors in the house.

The original configuration of the Queen's Bedchamber is best appreciated by reference to the model commissioned by the Victoria & Albert Museum. Below the dais, the floor was covered with oak 'parquetting at 16s ye yard'. Geometric parquet was apparently first introduced to England by Charles I's widow, Queen Henrietta Maria, in her apartment at Somerset House in 1661–1662. The style originated in late fifteenth-century Italy, but came to England via France (where it had been in use since at least the 1620s), and Holland.[6] Its pattern, of alternating criss-cross and diagonal motifs within square fields, is very similar to the floor depicted in a 1680s French engraving (Figure 16.1), and similar flooring of 1656–1657 is still in situ at the Hôtel Lauzun, Paris.[7] Both French and Dutch craftsmen are recorded in the Lauderdale accounts (e.g. 'Hendrick Mommers the Dutch Joyner') but this floor is known to have been

[6] For the history of such floors in Northern Europe, see Thornton, 1990, pp. 85–92, and Gilbert *et al*., 1987; for their origins in Italy, see Thornton, 1991, pp. 60–64.

[7] For a colour photograph of the flooring at the Hôtel Lauzun, see Thornton, 1990, Plate IV.

laid by Henry Harlow, who also described himself as a joiner and who worked in partnership in this room and in the adjoining closet with John Bullimore who carved the decorative elements of the wall-panelling. Harlow billed for 'wood given the Carver' and for 'fitting his work in place'. Harlow's own masterpieces are the elaborate marquetry floor behind the balustrade of the dais, and the similar floor in the Queen's Closet beyond (see Plate 66). On either side and in front of where the bed once stood are the monograms and coronets of the Duke and Duchess of Lauderdale in 'Cedar inlaid wth wallnutt tree'[8] for which Harlow was paid 35s a square yard, more than twice the rate for the parquetry elsewhere in the room. The technique was similar to the inlaying of furniture with decorative woods cut in patterns. As well as cedar and walnut (in the Queen's Closet a straight and cross-grained walnut is contrasted), holly was used for the coronets and ciphers, with box-stringing around the edges of the strapwork. The holly was stained green for leaves, or in red and green to indicate the jewels set into the ducal coronets. Shading was achieved by 'scorching' (the selective charring of woods to give three-dimensional relief to the marquetry). In France, this was called *parquet marqueté* or *parquet de marqueterie*, and was often executed by the finest cabinetmakers (Harlow supplied furniture for the Ham library in 1672–1673). For example, a drawing exists of a more elaborate, but not dissimilar, floor, incorporating a cipher and crown, which was laid in 1683 by Pierre Gole, the *ébéniste du roi*, in the Cabinet Doré of the Grand Dauphin at Versailles.[9]

Harlow's floor in the Queen's Closet, a private room beyond the dais, is the more impressive because it survives intact in a room that retains most of its original furnishings and furniture, as described in the Lauderdale inventories (see Plate 67). Here, there is also a dais, this time within an alcove, for the Queen to relax in private seated on one of two surviving 'sleeping chayres', throne-like but comfortable upholstered chairs with adjustable backs. These must have faced each other across the dais, revealing in between another ducal coronet set into the floor. Harlow was paid £1 18s. 9d. for 'cross-flooring' 55 sq. ft. of floor to provide a firm support for the 'parquetting' for which he charged £13. 4s. 0d. for 16½ yards in 1673. The following year he had to spend nine days taking up and relaying the floor, perhaps as a result of the use it had received during the Queen's visit. Floors of this kind were (and are) very prone to the lifting of their inlay and were a considerable technical accomplishment, particularly on the grand scale of the Queen's Bedchamber. The marquetry armorials worked into Harlow's floor in the Queen's Closet are echoed in the hearth, fireplace surround and window-sill which were made in scagliola (here, in imitation of *pietra dura*) by a Roman craftsman Baldassare Artima, who was paid £5 'in Part for a Counter fitt marble Chimneypiece' on 24 June 1673.[10] The scagliola is in remarkably good condition, which suggests that the Queen's Closet was rarely used after Catherine of Braganza's brief sojourn at Ham.

Another factor in the excellent state of preservation of the floors in the Queen's apartment (which also included the room still called

[8] Buckminster Mss., quoted in Thornton and Tomlin, 1980a, p. 143. Celia Fiennes saw a similar floor in the State Bedchamber at Nottingham Castle in 1697: ' . . .the bed was rail'd in . . . the floore of the roome was inlay'd with Cyphers and the Corronet . . .' Morris, 1947, p. 73). A panel of marquetry flooring, similar to the Ham examples, incorporating the cipher (post-1692) of the 1st Duke of Montagu and his second Duchess, now serves as a table top at Boughton House, Northamptonshire (see Murdoch, 1992, Plate 9 and p. 214).

[9] Reproduced in Thornton, 1990 Plate 90.

[10] Buckminster Mss., no. 413. The discovery that the scagliola is Italian was made by my colleague, Miss Nino Strachey. Previously, it was thought to be Dutch (cf. Thornton and Tomlin, 1980a, p. 149).

the Queen's Ante-Chamber, whose parquet floor is en suite with the adjacent bedchamber) was their (at least partial) protection by covers when the rooms were not in use. Among the 'Winter furniture' of the Queen's Bedchamber in 1677 were 'Two Leathers to cover ye inlaid floore' which were listed again in 1679 as 'Two leather Covers for the Stepp'.[11] This obviously refers to Harlow's marquetry on the raised dais floor where two covers would indeed have been required, one for each side of the Queen's bed. Several eighteenth-century pieces of furniture at Ham retain similar leather protective covers which were provided by their makers as part of the original order. The Lauderdale inventories are full of references to covers for upholstery and wall-hangings, but this is a unique record of floor protection. Only two rooms had decorative floor-coverings – the Long Gallery, described as 'The Matted Gallery' in 1679, and presumably laid with rush matting; and the North Drawing Room, provided with 'One silk Carpet' in 1683 – so it is not surprising that a considerable amount of floor repairs is recorded in the Lauderdale accounts. It is interesting that many more floor carpets and rugs (as well as table carpets) are listed in the inventory of 1655 (see Thornton and Tomlin, 1980, pp. 6–33), taken on William Murray's death, and several of these, described as 'Turkie' or 'Persiane', must have been extremely expensive. Given that the Lauderdales were noted for their conspicuous expenditure at Ham and elsewhere in the 1670s, the absence of carpets in their inventories suggests that the new parquetry floors were sufficiently novel in England to warrant no floor coverings, other than those required for protection when the house was shut up.

The protection of the finest floors at Ham has recently re-emerged as an important issue, given the degree of public access that is now given to rooms that were intended to be private and exclusive. Fading and warping is minimized by the use of blinds, sun-curtains, the application of anti-ultraviolet film to window glass and by the installation (in 1991–1993) of a computerized environment control system that maintains the relative humidity at a conservation level. However, in certain rooms, physical protection has to be provided to allow visitors to see the rooms at all. In the Queen's Bedchamber and Closet, sections of the marquetry floors have been overlaid first with plastazoate foam, then with oil-tempered hardboard and finally with MDF boarding painted to match the marquetry by Miss Penny Wools. This has achieved the minimum visual disruption, and provided much more protection than a drugget. The same approach has been followed downstairs in the Marble Dining Room, where the painted boarding has had to be laid in the shape of a 'T' to allow for the inevitable three-way traffic in this room.

Figure 16.2 The Marble Dining Room: cleaning the marquetry floor of c.1744 in about 1992 (Photograph, F.R. Latham)

The Marble Dining Room, at the centre of the ground-floor enfilade, takes its name from the black and white chequered marble floor that was laid in 1673 to match the adjoining Great Hall floor. Only the threshold step survives, given that the floor was replaced in parquetry by the 4th Earl of Dysart, perhaps in 1756 when he hung the walls with the existing 'Gilt Leather Hangings, Mosaic Pattern' which were provided by 'John Sutton, Leather Gilder'. Like the leather hangings, the wooden

[11] Buckminster Mss., quoted in Thornton and Tomlin, 1980a, p. 147.

floor inlaid with squares, diamonds and lozenges of walnut, cedar, ebony, rosewood and poplar,[12] is entirely in sympathy with the oak carved panelling of the 1670s, and this suggests a consciously antiquarian approach by the 4th Earl. Much darkened by dirt and numerous thick layers of polish, the floor has been greatly improved by Mr John Hart's recent repair and restoration (Figure 16.2). Originally, the decorative woods were glued onto oak or deal support panels three feet square which were tongue and grooved together. The panels are fixed to the joists at the corners by screws and nails – there is no cross-flooring to support the panels as in the seventeenth-century floors upstairs. They are therefore more prone to damage, but the floor has survived remarkably well, apart from the usual lifting and separation of the marquetry. This has now been fixed in place, with larger gaps filled with slivers of stained balsa wood, thus allowing lateral movement.

The nineteenth-century plain boarded floors in the apartments of 1672–1674 on either side of the Marble Dining Room await similar treatment. Mr Hart has, however, already repaired and repolished all the parquet of the first floor, whether of the 1670s as in the Queen's Apartment, or of the 1890s as elsewhere. In most cases, its appearance was marred by excessive dirt and clogging with polish. Oak floors of this kind were traditionally waxed. In the Galerie des Glaces at Versailles, for example, the floor was rubbed with 'a little yellow wax . . . so that the oak wood keeps its natural colour, or perhaps the wax will make it a little yellower' and 'une brosse à frotter le parquet' (a brush to polish the parquet) was then employed.[13] Mr Hart's approach has been similar, but the final appearance remains darker than it would have been originally, due to subsequent wear and tear but also to a conscious decision that the floors should marry with darkened panelling and faded furniture. Flooring, especially when it is uncarpeted as in most rooms at Ham, makes an important contribution to the *tout ensemble* of a house, and the improvement in the look of the floors has been a significant, though a hitherto unsung, element of Ham's current restoration.

[12] For an analysis of these woods, see the report by Rowena Gale in the National Trust's Archive at Polesden Lacey, Surrey (unpublished).

[13] Daniel Cronström to Nicodemus Tessin the younger; see *Les Relations artistiques entre France et Suède, 1693–1718. Extraits d'une correspondance entre l'architecte Nicodème Tessin le Jeune et Daniel Cronström*, R.A. Weigert and C. Hernmarck (eds.), Stockholm, 1964; quoted in Thornton, 1990, p. 89.

Acknowledgement

No-one can write about Ham without acknowledging the generosity of Sir Lyonel Tollemache, Bt., in allowing the publication of documents in the family archive at Buckminster Park, Lincolnshire. All studies of Ham House and its contents also depend upon the publications of Mr Peter Thornton and Mr Maurice Tomlin, both formerly of the Victoria & Albert Museum. In compiling information for this article, I owe a particular debt of gratitude to Mr John Hart, one of the National Trust's Advisers on Furniture Conservation, whose repair and restoration of the woodwork at Ham has made a significant contribution to the Trust's continuing improvement of the house.

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17

Historic floors at risk

Uppark, a case study

Iain McLaren

17.1 Introduction

In the seventeenth and eighteenth centuries, floors seem to have been seldom polished. An American visitor to England in 1772 described them being 'washed and rubbed almost daily', so that they 'have a whitish appearance, and an air of freshness and cleanliness, which the finest inlaid floor has not always'. Small beer was sometimes used to scrub floors, and so was vinegar. But washing, because it made a room damp and could damage pieces of furniture and skirtings, was not as popular in practice as dry scrubbing. Susannah Whatman's manuscript housekeeping book of 1776 advises the use of 'as little soap as possible (if any) in scouring rooms, Fullers earth and fine sand preserves the colour of the boards, and does not leave a white appearance as soap does. All the rooms to be dry scrubbed with damp sand'.

Hannah Glasse in her 'Servants Directory', published in 1760, also recommends this method: 'take some sand, pretty damp, but not too wet, and strew all over the Room, throwing it out of your hand hard, and it will fly about the Floor and lick up all the Dust and Flew . . . sope is not proper for boards, and sand and water shews the grain, which is the beauty of a Board'. An alternative was to sweep the floor with herbs: 'take Tanzy, Mint, and Balm; first sweep the Room, then strew the Herbs on the Floor, and with a long hard Brush rub them well all over the Boards, till you have scrubb'd the Floor clean. When the Boards are quite dry, sweep off the greens, and with a dry Rubbing brush dry-rub them well, and they will look like mahogany, of a fine brown, and never want any other washing, and give a sweet smell to the Room'.

Without a large labour-force at hand to clear a room of furniture and to wash or dry-rub floors almost daily, it is hardly practicable to employ such methods today, particularly in houses open to the public, where floors generally need the protection of polish. On the other hand, it should never be forgotten that the dry, silvery look of old boards (in a room like the Saloon at Uppark) is infinitely preferable to the high polish too often seen in eighteenth century interiors today. (*Manual of Housekeeping*: published by Penguin Books in association with The National Trust.)

Uppark, a late seventeenth-century country house on the South Downs overlooking the English Channel, altered twice in the eighteenth century and again at the beginning of the nineteenth century, was severely damaged by fire in August 1989. During the fire, which destroyed the upper floors and roof, nearly all of the historic contents from the principal ground-floor rooms were rescued and, despite the intensity of the blaze which eventually enveloped these ground-floor

rooms, nearly half of the architectural fittings and finishes from these rooms survived, undamaged, so that they could be reinstated with little more than superficial cleaning.

The National Trust had acquired the property in 1954 and opened the ground floor and basement rooms to the public; its chief attraction was the interior, largely untouched since the 1850s, with only the minimum necessary care and maintenance since then. The National Trust decided to repair Uppark to match its appearance on 'the day before the fire' using as many salvaged components as possible and employing traditional materials and methods because:

(1) The rescued contents had a long and intimate connection with the house and needed to be returned to an appropriate and familiar setting.
(2) Sufficient of the fabric had survived to make an authentic repair possible without resort to invention or speculation.
(3) The National Trust, as custodian of a major part of the nation's heritage, was committed to the promotion of conservation craft skills.
(4) The Trust was fully insured for repair, and funds, which could not be diverted elsewhere, were available. Nevertheless the insurers would insist on a sound commercial approach; sentiment alone would not justify conservation, it had to be no more expensive or cheaper than replacement with new of equivalent quality.

The four-year repair and conservation contract commenced on site in June 1990 and, precisely one year after the fire, the first bricks were laid on the wall tops ready to receive the massive new oak roof beams and trusses. By this time the task of removing the ash and debris from the house was complete and the major operation of retrieving the remnants and assessing the damage to the floors was well advanced.

17.2 Construction of the floors, and extent of the damage

On the upper two floors, the structural floors consisted of oak beams and joists covered with plain softwood boards, approximately 25 mm thick and varying in width between 150 and 225 mm. This structure had been destroyed in the fire.

At ground-floor level the floorboards were, in the main, plain oak boards of roughly the same dimensions. Two rooms, on the east flank, had softwood floors of presumably nineteenth-century origin. Despite the apparent intensity of the blaze, all of these timber floors at ground-floor level, with the exception of one destroyed by falling masonry, survived with remarkably little damage. It became evident, as the salvage operation progressed, that the blanket of ash and debris from above, made soggy by firefighting water, had effectively insulated the surface of the floors (Figure 17.1).

In the Stone Hall, the original eastern entrance to the house, the Purbeck stone floor was unaffected by fire but suffered impact damage from falling debris.

At basement level the floors were mainly stone slabs laid directly on the chalk below, but only in two or three rooms did the original historic floors remain untouched by modern repairs and reconstruction. Although flooded by firefighting water none of these floors suffered lasting damage from the fire.

17.3 The salvage operation

The bulky debris and ash was carefully removed, with the ash being then sieved for recovery of usable remnants. This exposed the floors where each board was first numbered and recorded before being lifted and transferred to an environmentally controlled store nearby. It was discovered, during this operation, that each board was fixed to its neighbour by means of irregularly sized and spaced hand-made dowels, and fixed to the joist

Figure 17.1 Uppark. Ash and debris being removed from the Red Drawing Room, revealing the floorboards intact (Photograph, The National Trust)

below with a nail driven at an angle through its edge. It proved impossible to remove these secret fixings without damaging the boards, usually immediately below the nail. It was also discovered that the boards were finished on the top face and edges only, the underside being planed only where it sat on the joists below.

The variety in width and length of each board, coupled with the pattern of dowels and joist bearings, meant that no two boards were the same.

17.4 Archaeological finds

The floorboards themselves revealed nothing memorable or important but in The Red Drawing Room it was discovered that one part of the suspended floor structure had been repaired with old window frames carved out of the solid. It was known from other sources that the window sills at Uppark had been lowered, possibly during the first major remodelling of the 1750s (although a date of 1771 was found on one extended jamb) and it seems likely that these recycled joists were the original window frames. Although much cut about and mutilated, the dimensions corresponded. These joists were repaired and strengthened where necessary but otherwise not altered during the repair operation.

In the Stone Hall, where the Purbeck flags were damaged by falling debris, suspicions were raised by a severe outbreak of dry rot in basement lintels nearby. It seemed likely that firefighting water, and later rain water, had percolated through the floor and had found its way to these lintels, thereby creating ideal conditions for dry rot fungus to flourish. In order to avoid the cost of an abortive removal of the stone slabs, a radar survey was first carried out, which indicated that a series of voids probably existed under the stone slabs. This examination was sufficient to persuade the insurers that removal of the entire floor for a full examination was justified and indeed when this was done the remains of an earlier timber beam and joist floor was found embedded in the rubble fill over the brick supporting vaults. These timber remains had undoubtedly encouraged the development of the dry rot fungus adjacent. It became apparent that the stone floor was not part of the

original construction of the house, but had been inserted in place of a timber suspended floor. The inventory of 1705 refers to a 'Stone Hall' and the context suggests that it could be this room, which would indicate that the alteration took place soon after the house was built.

After removal of timber debris and the rubble fill the brick vaults were sterilized by prolonged ventilation and fungicidal sprays; the slabs, having been numbered on removal, were put back on a new bedding in their previous positions, including about a dozen broken and cracked slabs, where fractures were simply filled with mortar, no attempt being made to disguise the extent of the damage.

It was also discovered that one of the stone floor slabs was carved on its underside with a lion's head, now mutilated to fit in the space available over the brick vault. The style suggested that it had been part of a sixteenth-century decorative panel, probably from a gateway or a chimneypiece but no actual source has been identified. A plaster cast was made before the slab was returned to its original position.

17.5 The philosophy of repair

Of the eight timber floors in the principal ground-floor rooms, it proved possible to substantially reinstate five with relatively minor and peripheral repairs; one, in The Little Drawing Room, needed about 50 per cent replacement, and those in The Little Parlour and The Flower Room were renewed entirely.

The key elements of the repair philosophy followed the principles established at the outset and applied to the work as a whole.

Structurally sound boards were always replaced in exactly their previous positions (see Figure 17.2): repairs to significant scorching and charring were carried out by piecing in with the same timber, done in such a fashion as to appear almost invisible on first entry to the room but always discoverable under close examination. Boards damaged beyond repair or missing altogether were replaced with timber of matching species and grain. This repair and replacement material came from salvaged stock, none was bought in. Some, especially softwood, came from first floor boards found in the rubble. Oak was taken from places normally hidden, such as in a cupboard under the main stair. The decision to replace the radiators in the window embrasures with floor trench heaters meant that a useful source of original material became available where these trenches were cut.

Where substantial or total replacement was necessary, new boards were purchased and artificially finished to impersonate an aged finish.

There was considerable debate on the desirability of importing genuinely aged boards from architectural salvage merchants. On the one hand, an authentic appearance could be obtained without resort to subterfuge (which was in any event never particularly convincing) but on the other hand there was the risk that old boards could have been improperly, or even illegally, stripped from a historic building despite the vendor's assurances to the contrary. The Trust, and its professional advisers, were determined to avoid the charge of being involved, however remotely, in the destruction or spoiling of other historic buildings. This rule need not be slavishly applied, however. The origin of anonymous items such as floorboards cannot be easily proved, if at all, whereas identifiable items such as, for example, complete staircases may perhaps be legitimately transported from one building to another if the circumstances are known and approved by the statutory authorities.

At Uppark the wisdom of the decision not to import salvaged boards was further reinforced when it emerged that the cost of so doing was substantially more than starting afresh with new, and then applying an artificially aged finish.

Where boards suffered surface scorching without serious loss of structural capacity, the scorch marks were left visible. Many are

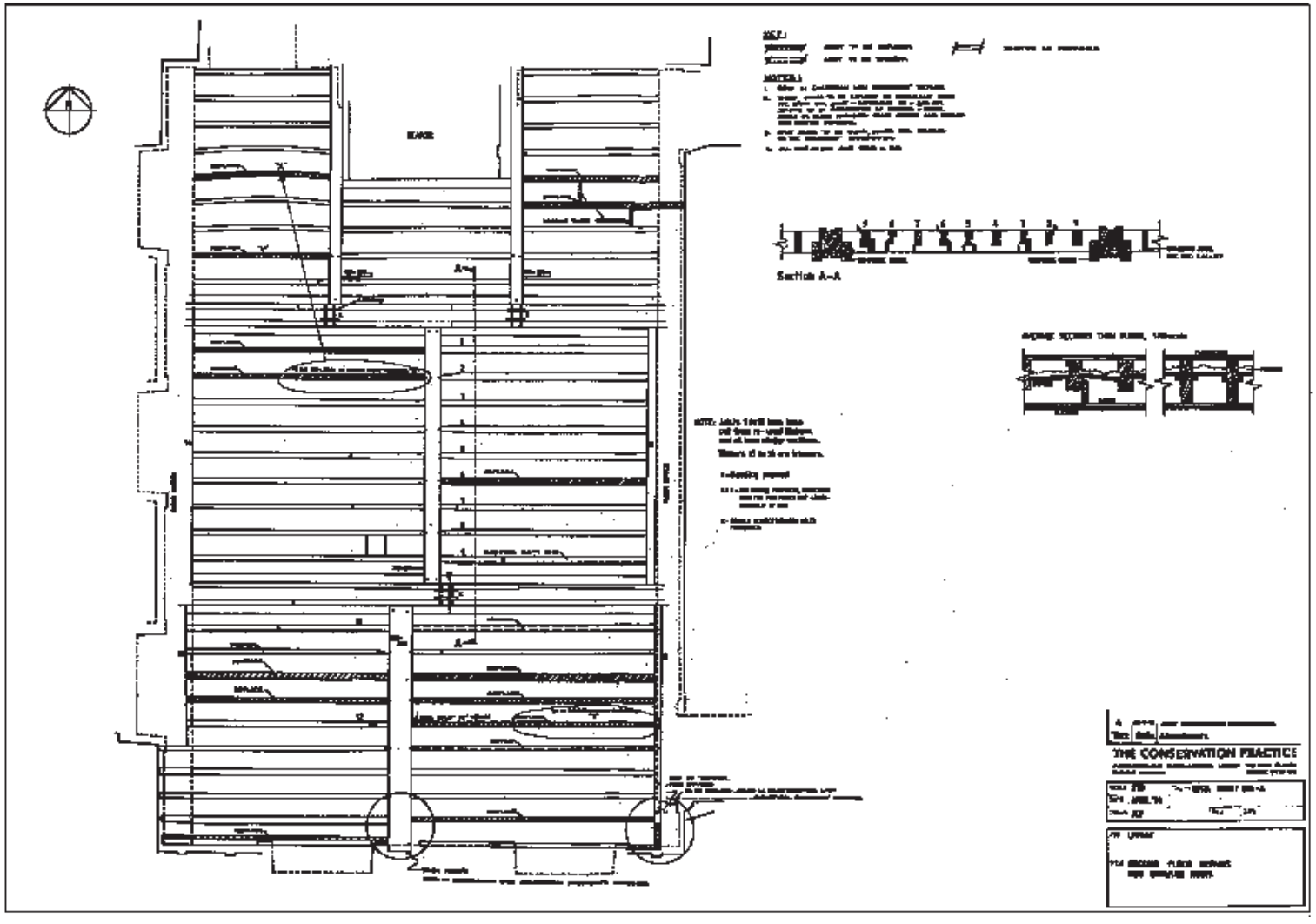

Figure 17.2 Uppark. Ground floor repairs – the Red Drawing Room (The Conservation Practice)

visible today, with carpets and other furnishings in place. Although it had been The Trust's intention not to display evidence of the fire in the house, it became obvious, as the boards went down, that some token of the catastrophe was a legitimate expression of the history of the house, in much the same way as the faded paintwork and gilding had been left unimproved, to demonstrate the passage of time.

Refixing of the boards, where one edge was badly splintered on removal, proved to be easily accomplished simply by starting again on the other side. The original dowel holes – and sometimes original dowels – were re-used and replacement dowels cut by hand where needed (see Plate 68).

No attempt was made to take out unevenness in the floor, not only because it would have been inappropriate in the context of an aged building, but also because surviving and reinstated panelling already incorporated the undulating contours of the original floor along its bottom edge.

17.6 Fire resistance

The fire at Uppark gained hold quickly, passing through unprotected floors with ease. In the reconstruction the new upper floors were built to provide one-hour fire resistance, not only to comply with statutory requirements to protect residential accommodation (under Section B of the Building Regulations) but also to protect the property and its contents.

This was accomplished, on the upper floors, by underdrawing the joists with silicate board and filling between the joists with mineral wool, an entirely modern practice. The new softwood boards were tongued and grooved to provide the requisite barrier against smoke penetration. There was sufficient room, within the new structure, to make these changes without reducing the original room heights and thereby the need to adjust the dimensions of salvaged components at ground floor level was avoided.

At ground floor level the situation was different, particularly in those rooms – the majority – where the original floor structure remained. The basement ceilings had all suffered substantial damage and had to be replaced; access for fixing linings to the underside of the joists and for inserting mineral wool was made available by the removal of the ceiling remnants. But it was with the provision of the smoke seal on floor level that difficulties were encountered. It would have been unthinkable to have jettisoned these boards merely to have complied with the Building Regulations; it was important also not to interfere with the historic, albeit awkward, fixing method. The solution adopted was to lay intumescent cord in the joints, just prior to driving the boards home on their dowels, but it has not been entirely successful. A year after completion, the cord is prone to being sucked out by vacuum cleaners and then has to be tediously encouraged back into the joint: sometimes the cord breaks and then a section is lost and cannot be replaced on the spot. A mastic intumescent sealant had been considered and rejected as being too difficult – or inconvenient – to replace in the event of the boards being lifted for necessary maintenance. It might have been better, perhaps, to have accepted that the boards were nearly impossible to lift without the risk of dislodging the smoke barrier and to have acknowledged that in the unlikely circumstances of the floor being disturbed a convenient means of replacing the smoke seal was not warranted.

17.7 Structural loading

It hardly needed calculations to be done to know that the repaired ground floor at Uppark would not comply with the modern Building Regulations standard of 4 kN/m² for Public Assembly. However, what is often perceived to be a major obstacle to the successful repair of a historic building proved to be a triviality at Uppark. For when the visitor route was plotted on the floor plan it

was found that the routes invariably fell outside the middle third of the span, where they might have been critical. This, coupled with the restrictions placed on visitor numbers as a management policy, meant that nowhere did the actual loading exceed the capacity of the floor structure as calculated by the Building Regulations.

On the upper floors, in residential use only, the regulation standard of 1.5 kN/m^2 was comfortably met without a fundamental departure from the pre-fire arrangement.

17.8 Finishing techniques

The National Trust desired that the floors in the principal rooms at Uppark, should be washed only and not given any other form of surface treatment, in accordance with traditional practice for floors of this type and as described in the Trust's own *Manual of Housekeeping* (compiled by Penguin Books in association with The National Trust): an extract from ch. 5, dealing with surface treatments used in the past, is reproduced at the beginning of this chapter.

The salvaged floors, repaired and refixed, were still grubby from the fire. The first cleaning operation was carried out by scrubbing the floors with damp sand applied with a bristle brush. The debris was then removed with a silicone sponge. This process proved to be remarkably successful in transforming the appearance of the floors although in the Dining Room, the one softwood floor to be treated in this manner, there was a tendency to soften the grain, producing many splinters. At a later stage the floors were washed with clean water which removed further quantities of ingrained dirt from some rooms. In the Saloon, where the boards were narrow and tight grained, most of the dirt came out during the first scrubbing operation.

A number of experiments were conducted to ascertain the best method of artificially ageing new boards, which were fitted in The Small Drawing Room (oak, about half), in The Little Parlour (pine, all new) and in The Flower Room (oak, all new). These experiments ranged from applying various dilutions of lime water to bathing a sample board in ammonia fumes, but none was found to be either controllable or successful. In the end, water-based colour stains were used, which certainly gave an impression of age, but there is clearly no effective substitute for the genuine passage of time, particularly on softwood floors where the alternating bands of summer and winter growth become clearly differentiated by foot traffic over time.

In The Little Parlour, where the pine floor was entirely renewed, the initial effect of the stain was certainly not convincing but after just two seasons of visitor traffic the boards have been sufficiently abraded to create a more acceptable aged appearance.

In practice, with carpets and druggets in place, the shortcomings of the new work are not readily noticeable. Conversely, the character of the repaired old boards is an important aspect of those rooms where they have survived.

In the Staircase Hall, where a high percentage of old oak floorboards survived but where the oak staircase was almost entirely new, the surface of the staircase was finished with a traditional beeswax polish as it had been before the fire. Whilst it was relatively easy to achieve a convincing aged colour in the wax, no attempt was made to injure the surface of the new wood to simulate natural wear and tear. It was felt that the subtle distinction of texture between old and new was an appropriate testimony to the catastrophe, whereas to have expressed the difference more vividly would have distracted the eye from an appreciation of the room as a whole.

17.9 Records

An essential ingredient of the Uppark repair project has been the assembly of a detailed record of the work, both for academic inter-

est and for monitoring the performance of the various techniques employed.

Each floorboard had, at the outset, been given a 'small find' number and these have formed the basis of the drawn record of the reconstruction, together with an account of the materials and methods used by the contractor.

17.10 Stone floors in the basement

These floors survived the fire and subsequent flooding with relatively little damage and might not have been disturbed at all had it not been necessary to introduce several new drainage lines under the floor slabs.

There was considerable evidence of earlier disturbances and in several rooms the original stone slabs had been replaced by modern concrete, sometimes overlaid by mastic asphalt. Only in the Beer Cellar and in some of the corridors did the original stone floor remain, and in all of these the tight joints of the first construction, still visible in many places, had been lost to the depredation of later generations who evidently cared little about these floors and who were content to put back scarred and chipped slabs with broad mortar joints, often with a high cement content.

Nevertheless it was felt that these admittedly ugly interventions were as important a testament to the building's history as the much more significant and important finishes in the principal rooms above. These slabs had to be lifted and they were replaced exactly as found, but substituting hydraulic lime for the Portland cement previously used for pointing. Drainage inspection covers have, in the main, been concealed under slabs and their location carefully marked on the drawings.

17.11 Conclusion

The repair and conservation of Uppark was important for many notable achievements, amongst them the revival of defunct eighteenth-century plastering skills, also the development of special decorative finishes and techniques.

So far as the floors were concerned the work proved that it was possible to successfully rescue and restore these humble yet important features of the building's interior, at no more cost than total replacement, and in the context of a rigidly controlled contract programme.

Had the fire occurred twenty years earlier, the whole project might not have been undertaken; ten years earlier and the floors might have been completely renewed. But there can be no doubt that the reinstatement of these old floors, however patched and scarred, makes an immensely valuable contribution to the quality and character of the restored rooms, confirming that the decision to repair and conserve, rather than replace, was the correct one.

18

Encaustic pavements. Conservation, protection and replacement issues

The Palace of Westminster

A.T. Jardine

18.1 Background

Although there are floors of other materials in the Palace of Westminster, only the coloured, patterned encaustic floor tiles found in the principal circulation areas of the building are considered here. The concept of the encaustic tiles, that of impressing a decorative shape into the top surface of a plain tile and then filling the depression with a clay slip of a different colour before firing, goes back to medieval times and has its beginnings in the thirteenth century.

The craft died out in the sixteenth century partly as a consequence of the dissolution of the monasteries but the process was revived during the nineteenth century when it was patented by Samuel Wright in 1830 and developed and brought to perfection by Herbert Minton, greatly encouraged by the interest of the energetic Augustus Welby Northmore Pugin in his enthusiasm to promote medieval designs.

18.2 General

Retiling of the floor of Temple Church in 1841 with tiles made by Minton focused attention on the success and potential of the new process and in a paper dated 22 February 1843 addressed to His Royal Highness Prince Albert, K.G. in his capacity as 'President of Her Majestey's (sic) Commissioners for encouraging the Fine Arts in connexion (sic) with the rebuilding of the New Houses of Parliament', Charles Barry suggested, amongst many other things, 'That the floors of the several halls, galleries, and corridors should be formed of encaustic tiles, bearing heraldic decorations and other enrichments in colours, laid in margins and compartments, in combination with polished British marbles'.

The suggestion was apparently accepted and as a result there are many areas of encaustic tile pavement in the Palace. They range in size from under 1 m^2 to the largest, the Royal Gallery, which has a floor area of 478 m^2 (see Figures 18.4a and 18.4b).

The earliest example is in the Peers' Lobby (Figures 18.1a and 18.1b). It was laid in 1847 and by early 1852 the Central Lobby (see Plate 69) and St Stephen's Hall were completed and in use. According to Benjamin Ferrey's *Recollections of Augustus N. Welby Pugin* published in 1861, Pugin wrote to Herbert Minton in January 1852 saying 'I declare your St Stephen's tiles the very finest done in the

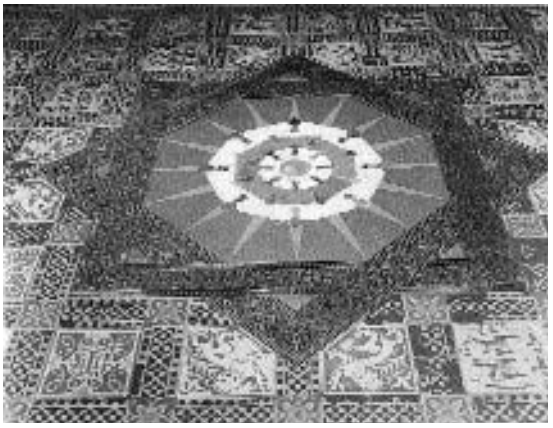

Figure 18.1a Peers' Lobby, Palace of Westminster (Photograph, George Garbutt)

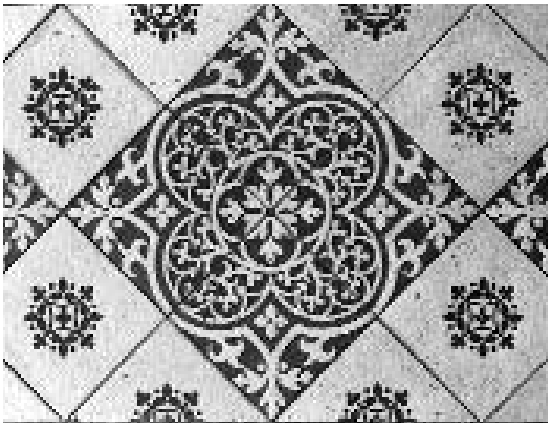

Figure 18.1c Tiles from Peers' Entrance, Palace of Westminster (Photograph, George Garbutt)

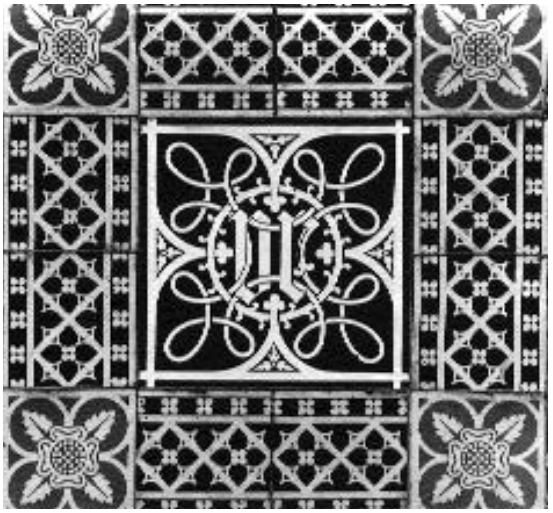

Figure 18.1b Tiles from Peers' Lobby, Palace of Westminster (Photograph, George Garbutt)

tile way; vastly superior to any ancient work; in fact they are the best tiles in the world, and I think my patterns and your workmanship go ahead of anything'.

The tiled floor areas do not consist entirely of encaustic tiles. They are divided into panels of various shapes bordered generally with either slate, marble or other stone, and the panels are themselves often further sub-divided by the inclusion of small slabs of slate, or black or chocolate brown tiles to relieve the effects of the colour in the encaustic areas. The principle of panelling, compartmenting and relieving with monochrome was established by the medieval pavement designers.

There are various shades of slate laid in conjunction with the tiled areas and they range from blue-black to grey-green. Despite many enquiries it has not been possible to ascertain the sources of the original slates, or to match all of the colours. *The Builder* magazine of 1845 stated that 'An immense quantity of the slate from the quarries on the estate of the Knight of Kerry, Valentia Island, has been ordered for the New Houses of Parliament'.

The areas of white stone associated with the tiles are of Hopton Wood, a Derbyshire Limestone.

Apart from the Peers' Lobby, where the tiles run parallel with the walls, and Central Lobby which has a unique octagonal layout, the tiles in most other areas are laid diagonally.

So far as the tiles themselves are concerned, the majority were designed by Pugin. Except for the large tiles used in the Peers' Lobby which are about twelve inches (305 mm) square, and the centre of Central Lobby which is composed of concentric rings and some circular tiles (Figures 18.2a and 18.2b), most of the tiles are six inches (152 mm) square.

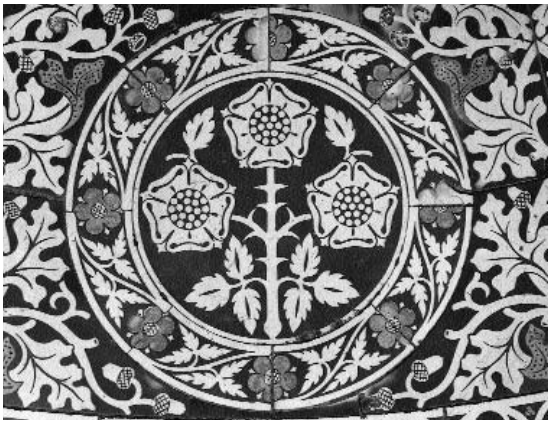

Figure 18.2a Tiles from Central Lobby, Palace of Westminster (Photograph, George Garbutt)

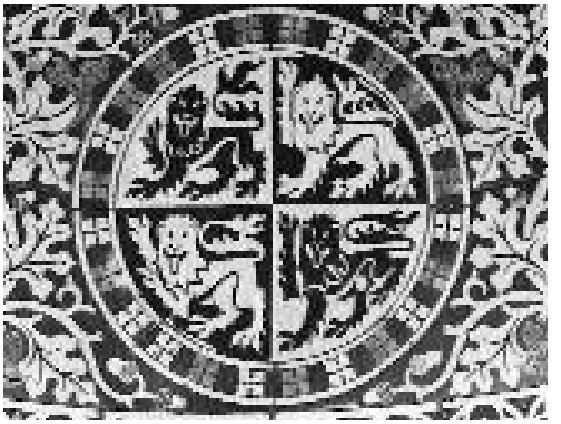

Figure 18.2b Tiles from Central Lobby, Palace of Westminster (Photograph, George Garbutt)

Normally the original tiles are one inch (25 mm) thick and consist of a top and bottom layer of fine clay separated by a rougher mix of red grog. The undersides are impressed with holes to assist drying out and keying and the words, MINTON & Co PATENT STOKE ON TRENT, and a number, thought to identify the person who made them. No date stamp has been found on any of the tiles lifted so far.

There are two main types of pattern construction in the tiles: those in which the decorative colours are separated from one another by the background colour, and those in which at least two of the decorative colours touch one another without separation by the background colour. Colours used are harvest/cane, terracotta, red, blue, black, white, chocolate brown and, in the Central Lobby centre-piece only, green. The greatest number of colours found in any one tile is five.

Tile patterns include gothic lettering, heraldic lions, shields, and foliated designs some of which can stand alone whilst others are combined in sets to produce a complete pattern. Some patterns are produced in different colour combinations. The coats of arms on the tiles in St Stephen's Hall include those of knights who fought at the battle of Crecy (Figure 18.3).

It is of interest to note that not all of the tile arrangements read as a complete design, being disrupted in some cases by the lack of continuity of the pattern across adjacent tiles.

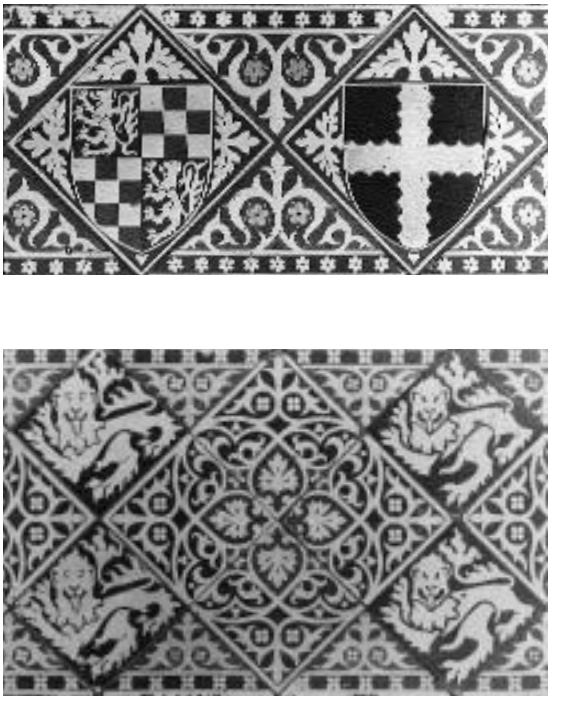

Figure 18.3 Tiles from St Stephen's Hall, Palace of Westminster (Photographs, George Garbutt)

18.3 Records and recording

Old guide books, magazine articles, photographs and other illustrations record the existence of an encaustic pavement at a particular time. Definitive pattern detail is not usually given although a guide book may provide details of any wording. Areas of tiling are visible in the black and white photographs of the interior of the Palace taken by Sir Benjamin Stone in the late 1800s and early 1900s but the specific patterns are not usually clearly discernible.

Black and white photographic surveys have been made of the major pavements in the Palace and these are presented as rectified photo-mosaics showing the whole pavement.

The tiled floor to the Members' Lobby of the House of Commons was lost as the result of Second World War bomb damage and unfortunately its specific details appear to be unrecorded.

As more and more wear takes place, it is very important to ensure that a good record is kept of the pattern and colours of every individual tile design. This is being done by taking high quality colour photographs. Fortunately, in most areas, wear is not uniform and the pattern repeats into less worn areas so that sample tiles should also be available. This may not always be the case and, in the absence of a good tile sample, any future replacement will have to rely on good photographic records for the correct details.

18.4 Monitoring wear

Wear can either be monitored by taking regular accurate level measurements at strategic points, or by comparing the loss of pattern shown on photographs taken at intervals. The latter method is only applicable if a part of the pattern is already completely worn away. The heaviest wear follows the heaviest traffic but is accentuated where pedestrians change direction and where softer stone adjacent to the tiles has worn down more quickly, putting extra stress on the harder tile surface.

18.5 Consequences of wear in a heavily used 'live' historic building

It is inevitable that in a very busy 'live' historic building still being used every day for the purpose for which it was originally built the floor surfaces will eventually become badly worn. Daily records are not kept of the number of people entering the building but it is believed that on one day as many as 20 000 people did pass along the Line of Route, a fixed path followed by authorized visitors through the principal spaces of the Palace.

In addition, daily users of the building include the Peers, Members of Parliament, Officials and Staff, and visitors to the Strangers' Galleries of both Houses, to Committees, to functions, on Parliamentary business, or to lobby their Member of Parliament.

Parts of the most heavily used floors have become very worn. They are getting progressively worse and many are nearing the end of their practical life-cycle. This has resulted in the loss of part or all of the pattern from some of the tiles and a slightly undulating profile to the surface of the floors generally, including the stone and slate slabs. Generally the effect of the wear is aesthetic rather than hazardous although some of the tiles have suffered mechanical damage such as cracking and breakdown of their outer layer revealing the inner core material.

In order to consider the problem as comprehensively as possible, a Working Group was set up with the objective of examining all the factors, both philosophical and practical, affecting the wear, replacement and retention of the original floor tiles in the Palace. The Group included representatives from the Parliamentary Works Directorate, English Heritage and a tile manufacturer, advice being sought from others as required.

There are three main consequences of the wear, historical, aesthetic and safety. Historically, the wear represents the significant loss of an important part of the original fabric of the building which once gone cannot be recovered. Aesthetically, the architect's original

concept for the appearance of the tiled floors is degenerating and the appearance of the interior of the Palace is that much poorer as a result. The full pattern and colours of the tiles are an integral part of the architectural character of the interiors of the building and are there to be enjoyed as such. It is a regrettable fact that in their present state of wear, many of the tiles no longer radiate their original vitality and with people walking on them they will continue to deteriorate.

Because the colour which is left is, in many areas, very thin indeed now, it is anticipated that the rate of loss of the remaining colour in those areas will accelerate, making a marked change to the appearance of the floors in a relatively short time.

From the safety point of view, the gentle undulations are probably not too great a hazard. Holes caused by the breakdown of the structure of a tile and in which narrow heels may catch are potentially a greater hazard.

18.6 Protection and day-to-day care

The Palace is a highly used, living, working building, not a museum piece and to prevent people from walking directly on the tiles would be to deny the building its proper function. The reality of the situation is that the tiled floors of the Palace are neither everlasting nor indestructible. However attractive they may be in their own right, they were made for walking on, and it is inevitable that they will wear out. The process is not reversible.

Regular cleaning of the tiles to remove dirt is carried out using a dry or slightly damp mop and clean water. No cleaning agents are used.

In such a busy building as the Palace it is not considered that there is any real benefit in applying polish as it would soon wear off the heavily used areas and build up in an unsightly way on adjacent lightly used parts, causing a maintenance involvement.

To introduce a protective layer, e.g. a carpet, between the walker and the tiles would be to destroy the aesthetic effect of the tiles, although it can prolong their life. Indeed some tiled floors in the more private areas of the building have been carpeted over to reduce noise and to improve comfort. Strips of regularly maintained barrier matting are provided at the main visitor entrances to reduce the amount of grit and dirt carried onto the floors.

As well as being subject to wear from foot traffic, the floors are potentially at risk from heavy objects being dragged over them, by preparations for the State Opening of Parliament, and by works to the adjacent fabric of the building. Every effort is made to avoid damage by the use of soft-wheeled trolleys, briefing operatives on the care which needs to be taken, and by the use of physical protection such as boarding or sheeting as appropriate.

18.7 Assessment of wear/condition

Because many of the tiles have quite busy designs on them, loss of pattern is not always very obvious to the casual glance. However, a close visual inspection of a pavement does reveal the amount of loss of pattern and physical damage which has been suffered. In order to quantify and record this, a more comprehensive assessment was made of some of the tiled areas and colour-coded drawings produced. This assessment involved first drawing a plan of each bay of each pavement to allow each tile to be clearly identified. By using a simple three-colour code, the condition and state of the pattern of each tile was recorded on the drawing and an overview of the general state of the pavement obtained. The system can be further developed to evolve a strategy for remedial work and to assess the number of tiles of each pattern needing replacement.

The colours used were:

green: for tiles in good condition and with no loss of pattern. Very slight damage, such as edge chipping was accepted;
yellow: for tiles which had begun to lose their

pattern but not so badly as to detract from the overall appearance of the floor. Such tiles might give a further fifteen or twenty years or more of useful life;

red: for tiles which were badly damaged, had completely lost their pattern, or had lost so much pattern that their visual value was impaired and detracted from the overall appearance of the floor.

Tiles in the yellow category occurring in a predominantly red area would be considered for replacement, but would probably be left in a predominantly green area.

Because the system demands that each tile be examined, this was a most revealing exercise. Hitherto unnoticed repairs, wrongly substituted tiles and previously replaced areas were detected. Slight changes in the general colours showed up replacement tiles, as did subtle changes in the colours used to infill parts of the pattern. Some of these changes appear to be deliberate but not too obvious. Were they made to identify the replacements? Bearing in mind that encaustic tiles were still being produced at the beginning of the twentieth century, replacements could have been produced up to that time without any difficulty, and possibly as a matter of course, without raising any particular interest.

18.8 What can be done?/What should be done?

It is a key principle of conservation that material constituting original fabric of the building is maintained in use for as long as possible. In the case of the tiles, therefore, they should not be replaced until they are either a danger or so much of their original pattern has been lost through wear as to seriously detract from their intended visual impact.

Possible action ranges from doing nothing at all, through various degrees and combinations of leaving, repairing or replacing individual tiles, or replacing groups of tiles. Wholesale replacement of complete pavements is not considered to be either desirable or necessary.

There is only one way to allow the building to be fully seen and used as it was intended, and to allow the interiors to reflect the character with which they were conceived, and that is to replace areas of badly worn tiles with new ones at such time as the original tiles are judged to be aesthetically unacceptable and/or unsafe, having kept them in situ for as long as possible.

18.8.1 Replacement tiles

It is a prerequisite for the replacement of any encaustic tile that a satisfactory replacement is either available or can be manufactured. Other than a few held in storage, the specific patterns which are associated with the Palace of Westminster are not available 'off the shelf' and each one has to be purpose made. This, in itself, is a lengthy process demanding close liaison with the tile manufacturer and includes selecting a good example as a model, producing an accurate computer image of the pattern, making an accurate mould, developing a replacement of acceptable quality and manufacturing replacements for use.

As in Victorian times, much of the tile-making process is manual and highly skilled. Although there is now much greater control over the firing, the outcome from the kiln is not always entirely predictable and this may make it necessary to undertake some development and experimental work which can differ from pattern to pattern.

The modern replacements are only half the thickness of the original Minton tiles. This has no affect on their appearance or performance but saves material and assists manufacture.

In 1979 a bay of tiles in the southeast corner of the Royal Gallery which had been damaged during the Second World War was replaced. This was followed in 1980 and 1981 by two corridors off Central Lobby. In each case total replacement was undertaken.

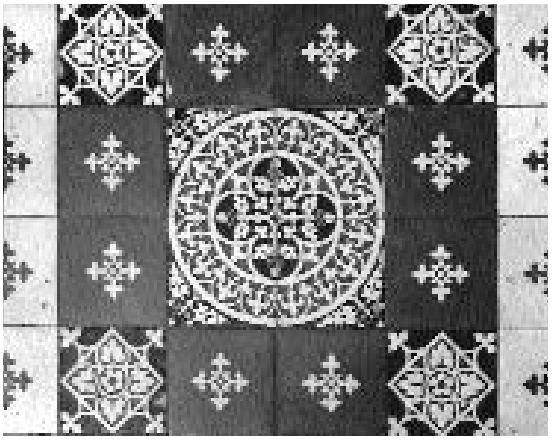

Figure 18.4a Tiles from the Royal Gallery, Palace of Westminster (Photograph, George Garbutt)

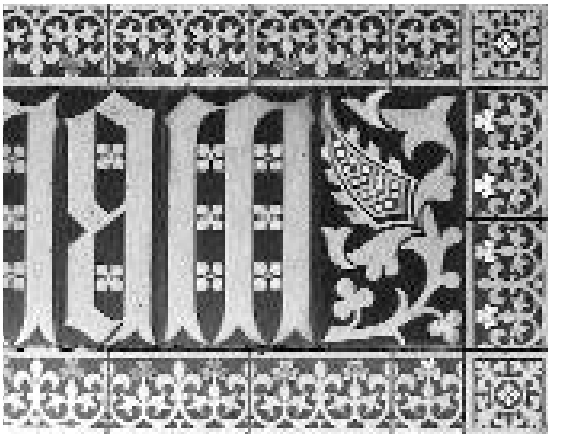

Figure 18.4b Tiles from the Royal Gallery, Palace of Westminster (Photograph, George Garbutt)

An area of about 3 m^2 of new tiles was laid at the west side of the Lower Waiting Hall in 1994, as a pilot scheme. This demonstrated that new tiles of an acceptable quality for the area concerned could be manufactured, and also showed that the existing tiles in the area had once been lifted and relaid in a strong cement mortar which prevented their removal without damage.

18.8.2 Practical considerations

In order to confine replacement to minimum areas, it may be necessary to remove small areas of worn tiles from within larger areas of tiles in good condition. The skill and ability to remove worn tiles without damaging adjacent good ones is most important, as is the ability to lift existing tiles in good condition without damaging them. If tiles in good condition can be lifted undamaged, they can be re-used or displayed. In the case of the Palace it is the intention to retain one good example of each original tile pattern for record purposes.

Of particular concern in this respect is the central design in the Central Lobby floor. It is in poor condition and shows several repairs with incorrect substitute tiles. If removed, it should ideally be retained but this is only feasible if the tiles can be released undamaged.

18.9 Conclusion

It is clear that apart from the relatively few tiles which are suffering from mechanical damage and breakdown, the effect of the wear is generally aesthetic rather than hazardous. It is also evident that over the years there has been a process of replacement and repair taking place, including coloured resin repairs to small localized areas of damage to individual tiles.

Full consideration must now be given to retaining as many of the original tiles for as long as possible whilst recognizing safety, aesthetic, and practical factors. This will lead to defining in detail the extent to which tiles need to be replaced and the development of a comprehensive conservation regime.

19

Historic floors at risk

St George's Hall, Liverpool

Donald Insall

St George's Hall, Liverpool, stands as an extraordinary architectural triumph of its period. The brilliant concept of a young Classical architect, Harvey Lonsdale Elmes, who died at only thirty-three years of age, the building was finally completed by his greatly senior countryman, Charles Robert Cockerell, and incorporated both the highest engineering skills and the finest craftsmanship of the Victorian era in Britain.

The Hall was designed to serve multiple functions, including those of law courts; with the vicissitudes of history, and the withdrawal in 1984 of this element of its use, a period of neglect ensued. Only more recently has the restoration of this great monument been undertaken, and a phased programme of repairs commenced, with the intention of bringing it back into early use.

The commanding feature of the magnificent central space at the heart of this building – the Great Hall – is immediately its decorative floor, patterned throughout and principally in encaustic tiles (see Plate 70). The medieval craft of making these resulted, between the twelfth and sixteenth centuries, in their extensive use in ecclesiastical buildings all over Europe. But in Britain, with the Reformation and the closing of the monasteries between 1540 and 1560, this skill had virtually died; for some three centuries, encaustic tiling had become a forgotten art.

In the mid-nineteenth century, when the new wave of archaeology swept the country, enthusiasts began to discover the sites of the old kilns, and to examine and record the designs of surviving medieval tiles in cathedrals and churches. Furthermore, in 1843 Prince Albert was present at a soirée at the home of the Marquis of Northampton, at which a revival of the technique was demonstrated. Soon afterwards its author, Herbert Minton, was commissioned to exercise his skills in tiling floors at Osborne, Isle of Wight, the summer residence of Queen Victoria. Born in 1793, Herbert was the son of Thomas Minton, whose business he had joined in 1817; by 1828 he had become interested in reviving this lost craft: the company were soon foremost in producing large quantities of tiles, and for a rapidly growing market further stimulated by the work of the most prominent architects, among them Augustus W.N. Pugin. The magnificent Hall floor at Liverpool, executed in 1853, immediately followed his successes at Osborne and the Palace of Westminster, but exceeds them in grandeur as one of the finest examples of its kind.

The overall design of the resulting floor, by Cockerell and Gruner, is contained within a framework of diagonal panels, in turn supporting a celebration of great overlaid circlets, set very much like lilies in a pool, and each surrounded by multiple margins of

elaborate concentric design. Four curving bands of figures designed by Alfred Stevens represent the sea, supervised by Neptune with his trident and accompanied by dolphins, sea-nymphs, mermaids and mermen and enclosed by a Greek key-pattern frieze (see Plate 71). The central feature is a Royal coat-of-arms; flanking it are the arms of Liverpool, the star of St George of England, the Rose of Lancaster, the Thistle of Scotland and the Irish Shamrock. Against the organ is the Prince of Wales' feathers motif, later to be repeated in the Parliament buildings at Melbourne; other designs recur in the recently repaired floors of the Capitol building in Washington, USA. Lettered inscriptions around the perimeter of the design refer to the bas-reliefs in the ceiling panels above, and include the themes of Temperance, Prudence, Art, Science, Justice and Fortitude. Their borders in turn are set in Portland stone, laid flush with the tiling.

The decorative central area of the floor is recessed by five steps below its outer border; the upper level serving as an extended plinth to the ground-floor wall supporting a gallery above: this device also permitted the inclusion of input grilles for warmed and conditioned air. From an early date, however, and as a practical expedient both to level and protect the central floor, it has been covered by a removable wooden decking (see Plate 72). This was rarely removed, so that the full design of the stepped floor was only occasionally to be seen.

A detailed study of the fine architectural interiors and features at St George's Hall was commissioned by the City of Liverpool in 1991 with the support of the J. Paul Getty Grant Programme and was executed by Donald Insall and Associates, Architects. Their report recommended that more practical alternatives to this heavy emergency decking should now be considered; a suggestion was made that this might be formed of thin plywood sheeting on a polystyrene cushioning layer, and might carry a patterned carpet repeating the design of the decorative floor beneath.

In the event, a modern version of the earlier wooden floor-decking was constructed and is now in use. But the significance of this temporary protection of both dates is that even after 140 years of life, the central area of the tiling remains in remarkably good condition.

It is the surrounding raised sections of the floor around the perimeters which now show the effects of most wear; this is particularly marked around the principal entrance doorways. The effect has been that the stone borders have become dished and show differential wear, while the patterned surface of the tiling itself has in many instances simply become degraded and worn.

The tiles in turn now display with great clarity by their varied ageing the two ways in which they were made, and which result in their entirely different wearing characteristics.

The 'geometric' tiles forming the background of the design are of fired clay, consistent in colour and texture throughout their thickness. Their general colour is, as a result, virtually unaffected by wear and erosion which have had little effect upon their appearance and here become relatively less noticeable.

The 'encaustic' tiles, on the other hand, the revival of whose manufacture had been so energetically encouraged by the young Prince Consort, reflect the medieval technique. The clay is mixed, sieved and compressed, then de-watered and forced into moulds. Within the body of each tile the pattern is built up in coloured clays, taking care to scrape back the surface to an exact level, and fused with the base in a single firing. The resulting tile carries decorative designs of different coloured clays, laid upon and set into the plain clay body and fired with it as one.

The differential wear which has resulted is today quite marked. In terms of surface erosion and tangible loss of thickness, it is the surrounding stone margins which have become abraded and out-of-line, particularly where they abut the harder tiling. The tiled areas only really show their wear in panels of the encaustic variety, where the multi-coloured patterning has begun to fail, and the sharpness, clarity

and detail upon which the design depends has in turn become blurred, so that a great floor now shows its age.

The repair of this damaged floor immediately introduces the age-old philosophical problems in terms of the acceptable degree of renewal, and of the relative importance of the design and of its original materials and workmanship. In addition, it may well be said that the mellowing effects of time are themselves one of the attractions of an old building, and that the texture and pattern of age can have a subtle value of their own.

Very similar problems have of course been encountered in the case of other encaustic tiles such as those of the flooring at the Capitol in Washington, where a few purist visitors have suggested that the sense of age and of history has in part been sacrificed. There is, perhaps fortunately, no argument in relation to these floors about any significance of individual variations and of human artistry in the actual craftsmanly execution of the design, as apart from its concept. As ever, it is a decision really between the relative claims of originality, of design survival and of the marks of time, and of the relative values of each. And on this, there is inevitably room for differences of assessment; of subjective value and of sheer opinion.

Firstly perhaps, one asks how damaged is the design, and how far its unity and detail can now be saved and its life extended for continuing enjoyment. Some of this has been lost in the case of the roundels, but some survives, as no doubt do both deliberate historical records and much accidental evidence such as old photographs. It seems likely that missing elements could be recreated without undue intervention or hypothesis.

The question arises, however, that although the process of manufacture fortunately is not lost, and is being actively practised again and with considerable skill and care, new tiles have initially and inevitably a sharper colour than the old ones – unless, that is, a new and softened set of colours is introduced. In turn, one cannot forecast how differently these might age, and how apparent with increasing time might be the intrusions of modern repair.

H. & R. Johnson Tiles Ltd have given useful detailed recommendations for repairs. They point out that the very accuracy and tight jointing of the original tiling may produce problems of their own, since it is difficult to break out and extract an individual damaged specimen without danger to adjoining tiles, let alone to shape and rub to exact dimensions a newly fired tile and replace it with minimal tolerances into an existing, finely jointed pattern.

The replacement of individual tiles will, they stress, be labour-intensive, and of course more costly per tile than in whole panels, but it may be appropriate where there is a localized fault, such as a deteriorating crack or chip. The consultants have, therefore, suggested that limited local areas might now be lifted, particularly in areas of marked or excessive wear, any salvaged tiles being grouped for re-use together elsewhere. In this way, any contrast of newly introduced replacement tiles might be accommodated within the design in a less disruptive and patchy way, and the new panel will possess a more acceptable unity within itself. As it happens that the maximum wear has occurred at the main entrances, which are a focal and symmetrical element within the design of the Hall, the symmetry and balance of the whole floor design may in this way not be unduly compromised. In practical terms, the difficulties of laying new tiles among, and possibly damaging, the existing ones will be reduced. The intention will thus be to keep areas of physical replacement to a minimum compatible with restoring missing and damaged areas of the original design.

Perimeter zones bring two particular problems. A scrolled edging pattern to the main panels has lost some of its detail: but the plain terracotta-coloured base thus revealed seems not inappropriate and could well be maintained at this point, sacrificing here the completeness of the pattern to the more acceptable claims of age. This solution will also provide acceptably for the way the

leading edge of some tiles has now become exposed by the wearing of the adjacent stone, and where a marriage of wear-levels thus remains possible.

The long lettered panels present another, different question: the rear edge-tiles retain their form, although worn, but the front ones are quite worn away. In this case either the front 'letter' tiles only can be renewed, accepting their worn partners, or else both may be replaced, releasing salvaged ones for similar use elsewhere.

Whilst there can be no definitive solution in advance and on every detail, these proposals aim to be conservative in restoring to the Hall something of the splendour of the original floor, from which the worn areas now so much detract. It is recognized that individual decisions on detail must still be taken as the work proceeds and as the skills of replacement are worked out, in the conservation of any fine work of art.

Lastly, the question of continuing maintenance deserves special consideration and care. The British Ceramic Tile Council and the British Institute of Cleaning Science point out that ceramic floor finishes are easily kept clean by regular sweeping, afterwards washing with warm water to which a little soapless detergent has been added. Cleaning agents such as household soap may react with very hard water, producing a scum which has in turn to be removed; thorough final rinsing is again vital. But normal usage must be constantly well-monitored to avoid physical damage or misuse. A fine decorative feature such as this decorative tiling is at the same time a practical floor finish, and also a work of art in its own right, and worthy of every continuing care.

20

The open house – the management of visitors

Christopher Hanson-Smith

The term 'sheer weight of numbers' is applied to a varied range of situations but when used in the context of floors, the literal truth is meant.

The abiding nightmare of all owners of buildings where the public congregate is the collapsing floor, with the danger of people being hurled into the void beneath. Staircases can be even more hazardous than floors; even the best managed properties are not immune to potential disasters.

At Woolsthorpe Manor, near Grantham, the supporting beams under the parlour floor of this modest Jacobean manor house suddenly gave way in 1974 and six visiting Americans ended up in the cellar below. Fortunately they suffered no serious injury and afterwards at least two were able to dine out on their mishap.

At Dyrham Park, near Bath, the main staircase of this late seventeenth-century mansion and an adjacent floor were found to have sagged due to the weight of visitors. Fortunately the damage was spotted before anyone was put at risk and the staircase is now closed. This danger does underline, however, the need for each property to have effective and comprehensive public liability insurance.

Common sense dictates that a structure designed for use by a family and its servants must suffer when subjected to an influx of visitors that in many instances can number over a million during one decade. In the extreme case of Chartwell in Kent, a Victorian country house rebuilt in the early 1920s for the Churchill family, the number of visitors in 2000 was 144,300 and, even worse, these were concentrated into one season of seven months. Double that number and you have the alarming total of 288,600 shod feet shuffling over the floors in just one year.

In National Trust properties regularly open to the public the number of visitors rose from 3 million in 1970 to more than 10.5 million in 2000. The most popular house in terms of numbers was Polesden Lacey in Sussex. The same trend applies to properties managed privately, the most popular of which attract many more visitors than any National Trust house.

When fashion dictated that women should wear stiletto heels the damage these lethal shoes did to floor surfaces was immediately apparent. It is calculated that the average sharp heel with a tip one-sixteenth of an inch square exerts a concentrated pressure of 960 lbs. Two heels resting on a few square inches of floor can therefore exert nearly a ton of pressure between them, causing irreversible damage to wooden floors in particular. This is well illustrated at Dyrham Park in Avon where stair treads and the landing floor have been seriously scarred and pitted (see Plate 73). No

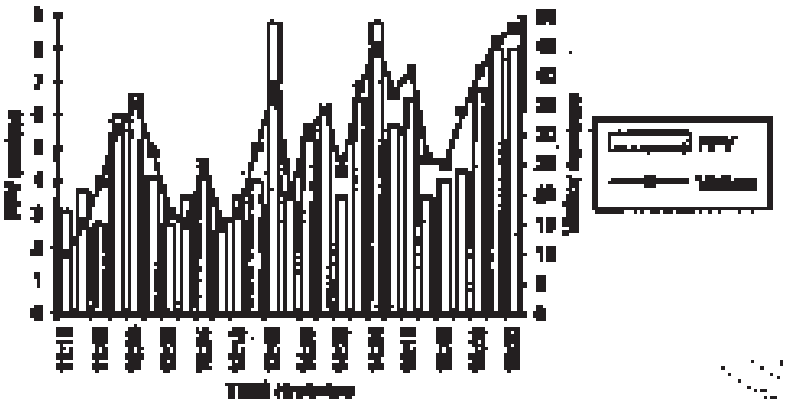

Figure 20.1 The measurement of peak particle velocity (PPV) made on 30 August 1993, in the Exhibition Room at Bateman's in Sussex (Courtesy of the National Trust and Helen Lloyd and Paul Thomas)

wonder, therefore, that visitors' shoes with stiletto heels must either be covered in an expendable plastic overshoe or the wearers be asked to remove them. Plastic slippers are so cheap at under 10p a pair that there is no need to recycle them.

A visitor to the great summer palaces of the Russian Tsars or the evocative Polish War museum in Warsaw will experience the shuffling lines of bemused visitors flopping around in felt overshoes. These seldom fit, easily fall off and make it impossible to clamber up stairs or cross carpets. They do, however, prevent damage to the exquisite inlaid floors and give them a high polish. The disadvantages of these overshoes make them impracticable for all but a very few houses that happen to have uniform floor surfaces without carpets or druggets. An added advantage is that visitor numbers can be controlled more easily.

Help will soon be forthcoming, however, in the shape of overshoes with crepe rubber non-slip soles; the whole shoe being easily washable. They evolved in response to the demand for shoes that could be easily worn by visitors with access to wooden-decked marinas and the polished decks of expensive cruisers moored alongside. The cost of these more sophisticated overshoes is at least £6 a pair; surely a perfect candidate for enterprising sponsorship?

Such measures, however well they prevent the damage inflicted by ill-shod visitors, do not address the root causes of overcrowding in houses and subsequent long-term damage to floors. Ways must first be found to monitor the wear-and-tear and then to determine the sustainable visitor capacity for each property.

Figure 20.2 Sign warning against use of stilettoes – Temple of the Winds, Mount Stewart House, Co. Down, Northern Ireland

The National Trust has already identified twenty-five of its houses where overcrowding at peak periods must inevitably result in forms of restricted entry. The damage caused to furniture, textiles, wall coverings and skirting boards is more noticeable than the potentially more serious but obscured damage to the floors beneath the visitors' feet. The means of monitoring such damage are equally as relevant to floors as they are to artefacts. The remedies also remain the same.

Each room or area on the visitor route commands a desirable capacity at a level that creates optimum viewing conditions without prejudicing the prime need for conservation. Estimates are then made of the maximum safe capacity for each room, followed by the desirable capacity sustainable over a season. There is usually a 30 per cent difference between the two estimates. Staircases, hallways and corridors must be allotted similar capacities the sum total of which, when added to those of the connecting rooms, give two figures that enable the property managers to manipulate the numbers and concentration of visitors.

Such a survey points to pressure points in a house where unacceptable levels of usage need to be avoided. Examples are cul-de-sacs that cause double the levels of circulation.

The insidious and cumulative wear-and-tear can best be recorded by regular monitoring over a season with the findings entered on record sheets, one for each item at risk in each room. The same work is required for floors in order to spot not only visible damage by scuffing and stamping but any underlying movement within the structure.

Floors can be timely pointers to structural damage that may not otherwise show itself; loosened parquet surfaces with gaps appearing between the blocks are a ready guide to structural stresses. The effects are even more pronounced when the floor has already been weakened by damp or worm infestation.

It is now scientifically possible to assess the forces that have the potential for damaging buildings thanks to practical research in National Trust buildings by Helen Lloyd and Tim Mullany, the initiative having first been taken by ICOMOS. Their method was to apply the indicator of peak particle velocity (PPV) as the velocity of particles set in motion by a disturbance, whether man-made or through the ground. Structural fatigue can easily be induced by high levels of vibration over short periods and also by lower levels for longer periods.

Thus the duration of vibration levels has a direct effect on structural response. Research in houses that attract high visitation has already identified PPV levels on a range of floors which exceed international guide levels. A geophone transducer is used for these tests, placed on the floor and as near to the visitor route as possible.

The natural frequency of a particular floor can be defined by using a simple 'single heel drop' technique in an empty room. The results of this impact test, coupled with the PPV reading for that particular floor, give an excellent indication as to the level of risk and potential damage. This is obviously not a remedy in itself but triggers action to prevent further damage; the most important decision is that of determining the optimum visitor level for the property at risk.

The one possible measure that conservationists all agree should not be tried is that of extending the hours of visiting in order to even out the flow of visitors. Experience shows that the essential cleaning regimen is curtailed and excessive exposure to light also results. Many properties impose a limit of 600 hours per annum of public access to rooms with a further 400 hours allowed for cleaning and maintenance. The total of c.1000 hours is regarded as a safe maximum limit. A simple formula is for each room to be maintained for one hour for each day it is opened to view.

Light bleaches all wooden objects and floors that are inlaid or painted are particularly at risk. More obvious still is the insidious damage by excessive light to carpets, rugs and runners which are often only there to protect the floors beneath them. The best protection is a closely woven, woollen carpet of Wilton quality as recommended by the International Wool Secretariat – and the thicker the better.

Beneath any carpet an underlay will prolong its life and below both should be a thick carpet paper that acts as a barrier to rising damp and prevents an underlay from marking a wooden floor.

Carpets woven from the coarse wool of the Cumbrian Herdwick sheep have been tried in houses that experience great visitor pressure. Such tough covering works well provided that

the carpet remains dry; it is very hard to dry out in situ. For small rooms 'Felt Lux' is adequate but it is only produced in a narrow range of colours and is inclined to 'walk' unless an underlay is attached to it. Plastic druggets are not a sensible option as condensation beneath them can cause mildew in the carpet protected and those with raised bubbles to produce a non-slip surface can cause permanent pitting in the carpets as well.

Sisal matting is a cheaper alternative to the thick rush matting which can cost more than the best Wilton carpet. The drawback to sisal is that it can mark the wooden floors it is supposed to protect so carpet paper is again necessary. It is well suited, however, to brick and stone floors.

At entrance doors coir matting, preferably fitted into a shallow well, is essential and, like the Wilton carpet, the thicker the better but not so heavy that it cannot be beaten or shaken. To be certain of removing dirt from shoes not less than three yards of matting are required in a continuous length leading from the entrance. Even with this barrier there is no guarantee that the deep clefts in ribbed rubber soles will yield all their hidden gravel and grit.

Retained sharp stones can cause great damage to bare floors and stair treads so it is wise not to have any loose surface immediately outside the entrance to the house. Pea-sized washed gravel embedded in either fibreglass or tarmac is both practical and looks good.

Oak floors stand up to constant heavy wear better than any other wooden floor in common use. They will last much longer if covered by a permanent layer of wax, such as 'Traffic' wax, which needs to be applied weekly. Another recommended coating is 'Premier Clean and Buff'. Any such barrier should be non-slip as the safety of visitors must be of prime consideration, and nowhere in the building is this more important than on staircases.

Some of the more elderly visitors are not used to stairs as their homes are often retirement bungalows so staircases must be equipped with bannisters or handrails and properly lit; often difficult to achieve in listed buildings.

Figure 20.3 Many properties now use timed tickets

Distractions on stairs such as windows on half-landings giving spectacular views or pictures hung on the walls of stair wells can often cause people to trip and fall. Carpets on steep stairs can be dangerous on the descent. The incidence of scuffed treads and risers is greater as stairs are mounted so visitors should ideally be led up carpeted stairs and down uncarpeted provided that they have a non-slip surface. Marble treads can be treated with a Platinum Emulsion polish which is diluted with water as required.

The most effective way of containing damage is to manipulate the frequency, the flow and the absolute numbers of visitors. People are amenable to control and even more so if the reasons for it are spelt out.

Instruction begins with the literature publicizing the particular property at risk. Telling intending visitors that they are about to enter a building which is sensitive to excessive wear will either put them off altogether or heighten their anticipation and awareness of it. A more fragile environment will evoke greater sympathy which, in turn, makes the visitor more receptive to instructions.

Before the entrance is reached discreet notices should announce the need for visitors to keep to demarcated routes and heed the

advice of the staff on duty. The guides, stewards, room wardens, attendants, docents – whatever their title – must be firm, sympathetic and well-informed about the measures necessary for preserving the structure and contents of the building. Many will be volunteers and deserving of as much training as the permanent staff – how else can they be expected to inform effectively? They are at the 'sharp end' in direct contact, very occasionally in conflict, with the public and have the best opportunity to explain, cajole and politely remonstrate with wayward visitors.

John Bailey, who was chairman of the National Trust in the late 1920s, stated then that preservation may always permit access, while without preservation access becomes forever impossible. This stark message must encourage visitors to think of the long-term future prospects of the house they happen to be in.

Membership of organizations dedicated to preserving buildings and their contents should not just be seen as a seasonal visiting card; there are responsibilities as well. It is in this frame of mind that visitors should be 'sold' the concept of the rationing of access by timed entry. The sustainable capacity of the house having been set, the number of tickets distributed will ensure that the safe maximum at peak periods will not be exceeded. Thus the property, floors in particular, will not suffer; the quality of visit will be enhanced – no overcrowding, no jostling on stairs and in doorways.

There must be advance warning in literature and on notice boards of the operation of a timed-entry system. Visitors' reception areas act as efficient and friendly collection points where policies can be explained and tickets issued. Because many visitors at peak periods may have to wait for admission there should be a tearoom, garden and playground at hand to make the time pass pleasantly – and profitably for the management. The main concern outside the house is to eliminate queues of impatient and disgruntled visitors (Figure 20.3).

The informal system of controlled entry does not involve the issue of special tickets; it does depend, however, on the ability to know from minute to minute how many people are in the house and the public rooms. This then allows only a 'safe' number to enter. Infrared counters at entry and exit points can provide an instant read-out to the person controlling the entrance. Long experience of the visitor flow-pattern can enable the setting of an entry rate which will give the required densities. A good example is Hill Top in Cumbria, a much-visited seventeenth-century four-bedroomed farmhouse that is now the Beatrix Potter museum. Ten people are allowed in every five minutes which ensures that never more than fifty are in the house at any one time. On wet days and holidays when hold-ups can occur, communication between the ticket office and custodian is vital so that people can be held in the shop and reception. Any increased spending results in more funds for the benefit of the property.

Because Hill Top is now one of the houses for which a safe upper limit has been set from the start of the 2000 season – 800 per open day – a more formal timed-entry system has been introduced. The time of arrival of each visitor is deemed to be the moment when he or she arrives at the head of the queue at the ticket kiosk. Tickets, showing the time of issue, are given out at the rate of ten every five minutes. Ticket holders are allowed five minutes to reach the house and can then stay for as long as they please. When the total number of tickets issued in any one day reaches 800 the house is then closed after the last visitor has departed. The garden and shop remain open until the advertised time for closure.

At Chartwell, where the visitor pressure grows annually and the house is larger, the flow of visitors is set at sixty every fifteen minutes. This system is of greatest benefit at the start of a day when queues form before the gate is opened.

An alternative method to formal timed entry involves the use of re-usable colour-coded plastic tokens. A set number of tokens is issued in each fifteen-minute period and

Figure 20.4 The front Hall, designed by James Wyatt, of Heveningham Hall, the Palladian mansion in Suffolk. The fine, inlaid stone floor deserves the most careful conservation. (Photograph, Christopher Hanson-Smith)

visitors are asked to return them as they leave the building.

For either system to be effective the rule must be that the sustainable limit includes parties, whether of school children or adults, special visitors, and those who come for a special function such as a concert or reception. Only by adhering to a well-proven policy that leaves no room for exceptions can a property hope to survive unscathed well into the next century.

One aim of the timed entry is to even out the flow of visitors who arrive independently; up to 98 per cent use their own cars. This very high percentage will inevitably fall as private motoring becomes more expensive and less enjoyable. Dedicated cycle routes are to be financed by lottery grants and many of these will eventually link up with popular places to visit. The integration of public transport must also encourage more people to leave their cars behind and join parties who come by coach and rail. The pre-booked coach party makes it simpler to forecast visitor flows and frequencies; the trend is to reserve more open days exclusively for parties. Connoisseurs days are for people who are prepared to pay over the odds for the opportunity to appreciate a house at greater leisure. The income from such special visits is particularly welcome as seldom is more than a third of the outgoings on a historic property covered by visitor income.

Visitors with physical and sensory disabilities are finding properties increasingly more accessible and welcoming. Wheelchairs pose much less of a threat to floors than to furniture and the decor but scuff marks from rubber tyres are unsightly. The installation of a lift can be a help to all visitors and reduces the need to use vulnerable stairs.

Access to any property can be tolerated just as long as it does not generate irreversible damage.

The hard decision may have to be taken to close a house at risk, or at least parts of it. An alternative may be to create a faithful copy; this has happened at Lascaux in France where visitors are diverted to a modern facsimile of the limestone caves to admire copies of the pre-historic wall paintings. Increasingly visitors may expect to be confronted with notices outside historic properties that bear the stark message:

FOR POSTERITY'S SAKE PLEASE KEEP OUT

Acknowledgement

The author is indebted to the staff at many National Trust properties for their advice and help, and in particular to Helen Lloyd, Housekeeper to the Trust, for taking such trouble in offering constructive criticism.

Materials and suppliers

Carpet paper	Your local carpet shop
Coir fibre mats	Norfolk Industries for the Blind 95 Oak Street Norwich NR3 3BP
Felt Lux	Your local carpet shop

	Bury and Masco Industries Ltd
Infrared visitor counter	Colebrook Consulting Ltd Diamonds Bells Yew Green East Sussex TN3 9AX
Plastic overshoes	Rexam Medical Packages 1–3 Dixon Road Brislington BS4 5QU
Premier floor polish	Premier Floor Products Oakley Gardens Bouncers Lane Cheltenham GL52 5JD
Traffic wax	Johnson's Wax Ltd Frimley Green Camberley GU16 5AJ
Underfelt	Your local carpet shop Gaskell & Co. (Bacup) Ltd PO Box 10 Lee Mill Bacup OL13 0DJ
Wire scraping mats	Weetman & Co. 124 Ashley Road Hale

Suggested reading

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Appendix

Cathedral floor studies – historic features and areas at risk

Jane Fawcett

Contents

Since the ICOMOS *Cathedral Floor Damage Survey* was printed (Fawcett, 1991), the Cathedrals Fabric Commission and English Heritage have issued *Cathedral Fabric Records*; a guide to the care and preparation of records, and the Commission has also issued an *Advisory Note on Good Practice for the Care of Ledger Stones and other Floor Memorials in Cathedrals*. The York Minster Working Group have formulated guidelines for recording ledgers (see Chapter 6) and many cathedrals have recorded their own floor inscriptions, some with photographs, for which NADFAS Volunteers have provided valuable help. These cathedrals include Bristol, Canterbury, Ely, Exeter, Gloucester, Lincoln, Norwich, Salisbury, St Paul's, Wells and Worcester Cathedrals, Pershore Abbey, and York and Southwell Minsters.

This is encouraging. However, very little active conservation has taken place, and many cathedrals still have inadequate floor records. The following entries include brief descriptions identifying some significant floors in cathedrals and greater churches in Britain.

A.1 Bath Abbey

During the restoration by Gilbert Scott, many ledgers were broken and relaid. The nave, west end and both aisles are paved with ledgers, many fragmentary, with white marble inserts, and brass inscriptions. None are exceptional; there are a few brasses, mostly nineteenth century, along the nave and cast-iron heating grilles in the aisles.

A detailed floor record, made by James Irvine, Scott's Clerk of Works, is lodged in the Reference Library.

A.2 Bristol Cathedral

In a private letter Warwick Rodwell writes: 'The eastern arm is a palimpsest of important historical evidence: there are hundreds of individual stones, medieval, early post-medieval, indents, eighteenth- and nineteenth-century tablets and vault markers, medieval tiles, etc.'. After the archaeological survey the floor of the south choir aisle was carefully taken up by Nimbus Conservation and nearly all the existing paving levelled and reset under the supervision of Alan Rome, Surveyor to the Fabric. Similar treatment is planned for the ambulatory, north choir aisle and north transept. This repair has created a precedent for sensitive conservation treatment (see Chapter 2).

The very fine marble pavement in the chancel and the magnificent Cosmatesque floor in front of the high altar, both designed by J.L. Pearson between 1899 and 1904, are in superb condition. The whole ensemble is one of Pearson's most successful creations (see Chapter 1, p.17).

There is a group of medieval tiles in the northeast chapel. A fourteenth-century indent of an Austin canon lies at the northwest entrance to the Lady Chapel. It is being seriously damaged by feet. The Pennant chequers in the nave were laid by G.E. Street when the Cathedral was extended in the nineteenth century.

A.2.1 Floor records

Dr Michael Smith of Bristol University, Department of History of Art, has recently completed a survey of all inscriptions, using Barrett's *History of Bristol* (1789) and *Cathedral Registers 1699–1837* (1933) to provide information on some of the lost inscriptions.

A.3 Canterbury Cathedral

The fame of Canterbury has brought with it great riches, including magnificent floors which have, in their turn, suffered to an unusual degree from iconoclasm and overuse. Although the shrine of St Thomas Becket in the Trinity Chapel was destroyed by iconoclasts, the fine *opus Alexandrinum* or Cosmati pavement, composed of small marble tesserae arranged in square and quatrefoils, was not.

The pavements of Trinity Chapel and the Corona, laid before 1220 to enrich the shrine, contain sculptured stone roundels, all probably laid by Italian craftsmen. Some paviours of a rare rose pink marble survive in the pavement originally surrounding the shrine. The steps, and probably the shrine itself, were also made of this material (Tatton-Brown, 1981). The position of the shrine is marked by a slab with lettering designed by Simon Verity. In the northeast corner of the Corona lies a geometric tile mosaic, and some inlaid decorated tiles laid around 1285–1290 after a visit to the shrine by King Edward I (Horton and Norton, 1981). These are unprotected. Trinity Chapel itself is now roped off for protection.

Much of the original Purbeck marble paving survives in the choir aisles. They were, however, cut through by central-heating ducts in the 1870s and given concrete covers. The other medieval floor still in situ is in the Martyrdom or northwest transept around the 'altar of the swordpoint'. Here the immense late medieval Purbeck marble grave slabs, from which the brasses have been plundered, lie in their original positions. They commemorate Archbishop Stafford d.1443, Archbishop Dean d.1501 and Priors Finch and Selling.

There are also nine seventeenth- and eighteenth-century ledgers, much worn. This area should be roped off, leaving a passage along the southern side for access to the crypt. 'The best way to look at the site of the martyrdom is not to stand on it, but to observe it from above (near the entrance to the north choir aisle)' (Tatton-Brown, 1981). I agree.

The nave was repaved in 1787, and all the ledger stones moved to the southwest transept, or to the chapter house. In the late nineteenth century the chapter house was repaved, and most of the ledgers were again moved, this time to the cloisters. In 1970 twenty-four of the heraldic ledger stones in the southwest transept were moved to safer positions along the nave aisles, due to damage from overuse, while the transept was temporarily paved with concrete slabs. Finally in 1993 the nave and southwest transept were again repaved (Chapter 4), and all the ledgers have been reset outside to the east of the northeastern transept.

A.3.1 Floor records

The Trinity Chapel and Corona floors from Canterbury Cathedral Chronicle 75 (1981) by Tatton-Brown (1981). *The opus Alexandrinum and sculptured stone roundels in the retro-choir of Canterbury Cathedral* by N.E. Toke (1930). *A Parisian workshop at Canterbury, a late 13th century tile pavement in the Corona Chapel, and the origins of Tyler Hill* by M.C. Horton and E.C. Norton (1981). J.M. Cowper's *Record of Inscriptions* (1897); S.G.A. Freeth's *Essay on Brasses* (1970); A.G. Sadler's *Monograph on Brass Indents* (1980).

A survey of all floor inscriptions with locations was made by Captain Tempest Hay in 1992 with help from NADFAS volunteers. There is no photographic floor record, but several floor plans (see Chapter 4).

A.4 Carlisle Cathedral

The fine brass to Bishop Bell, d.1496, lies in the middle of the chancel floor. The life-size figure has a prayer scroll, a triple canopy, a marginal inscription and is remarkably well preserved (Figure 1.37). The floor is paved with Frosterley 'marble' chequers.

A.5 Chester Cathedral

The rich encaustic pavements in the choir and sanctuary, designed by Gilbert Scott and J.R. Clayton in 1876, are composed of encaustic tiles, with roundels of saints, biblical scenes, floral and vine leaf motifs. Scott copied some of the medieval tiles found in the choir, and resited some in the north choir aisle (see Chapter 1). His fine Cosmatesque pavement at the crossing is badly worn in places. In the Lady Chapel the brass of 1845 is by Hardman, based on a Pugin design.

The cloisters have been partly repaved. There are very fine thirteenth- and fourteenth-century grave slabs with foliate crosses in the west and south walks.

When the nave floor was repaved in 1776 many ledgers were moved into the aisles or transepts. The nave and aisles were again re-paved in the mid-1990s amid considerable controversy, and many of the ledgers were lost.

A.6 Chichester Cathedral

The nave floor, in spite of a lot of post-medieval repair, retains about 40 per cent of its twelfth-century paving, altered by the random insertion of later medieval slabs. It is a rare survival, and the intention is to carry out repairs on the basis of replacement stones as required, so that the ancient character will continue to come through. There are several large indents and some ledgers with fine lettering. An immense matrix with brass indent, between the second and third piers from the west end, is thought by the Monumental Brass Society to mark the burial of St Richard.

Most of the ledgers were moved from the choir after repaving in black and white

chequers in 1829, and resited in the nave aisles. A few medieval tiles are reset near the altar.

The east end of the Lady Chapel is paved with encaustic tiles, while the Cosmatesque pavement in the choir is possibly by John Oldred Scott.

A.7 Christ Church Cathedral, Oxford

These floors are remarkably rich with interesting ledger stones. There are several brasses, including two in the Lady Chapel, John Fitzalyn d.1452, and Edward Courtenay d.1462, and one to Henry Dowe of 1578 in the north transept. A figure brass to James Coorthopp d.1557, was recently conserved and resited in a safer position (1994). A brass to Frederick Barnes d.1859, a figure under a canopy, was also repaired and reset in the Latin Chapel.

The beautiful Cosmatesque pavement in the chancel designed by Gilbert Scott in 1871 contains roundels of seated virtues. It is reputedly inspired by designs in the Cathedral of St John, Valetta, Malta (see Figure 1.31 and Plate 16).

A.7.1 Floor records

Inventory of Historical Monuments in the City of Oxford (1939), RCHME, contains some relevant information. There is no complete record of floor inscriptions.

A.8 Durham Cathedral

The grave slabs to early Norman bishops in the chapter house are unprotected and of great importance historically; one includes original filling to its lettering. The immense grave slab to St Cuthbert, placed behind the high altar in 1542 is protected by a curb made from green marble, reputedly from the demolished shrine. The matrix in front of the sanctuary step is to Bishop Beaumont d.1333 (see p.33), the brass a copy of 1951.

There are some eighteenth-century ledger stones, with good lettering, in the Galilee Chapel, subject to heavy wear. The nave contains a few ledgers; in front of the choir screen is a chequered black and white marble pavement, reused when the choir was repaved in 1870. In the south choir aisle are ledgers, some with armorial crests, lying between the columns. In the north choir aisle is a ledger to Walter Skirlm, Bishop of Durham d.1388, a brass of 1639, and several seventeenth-century ledgers. The Chapel of the Nine Altars also contains a few ledgers, particularly in the northwest corner. Outstanding is the splendid Cosmatesque pavement in the choir designed by Gilbert Scott, and laid in 1870–1875.

A.8.1 Floor records

A list of monumental inscriptions of the cathedral, was compiled for C.M. Carlton Ainsley's *Monumental Inscriptions of the Cathedral, Parish Churches and Cemeteries of the City of Durham* (1880); Surtees and Wall *Memorial Inscriptions in Durham Cathedral* (1932) includes the texts of all inscriptions on monuments and some floor inscriptions. There is no complete record of ledger inscriptions, nor a photographic record.

A.9 Ely Cathedral

Much of the Cathedral was repaved by Sir Gilbert Scott during this, his first cathedral restoration, commenced in 1847. Under the west tower is Scott's labyrinth design in black marble and white Mansfield stone and under the southwest transept lies his pavement of red Mansfield and black Purbeck chequers (Boddy, 1994).

The nave is paved with Scott's fine geometric design of red marble roundels, with bands of Purbeck, and a chequered border. A slab marks what is said to be the tomb of Alan of Walsingham, designer of the octagon. The north and south aisles are paved with black

and white chequered stone. In the south aisle a number of the blue lias stones have recently been replaced. There is a fine coloured figure brass by Wallers to Basevi, d.1845, who fell to his death while repairing the Cathedral, in the north chancel aisle (see Chapter 1, p. 21).

Scott's first encaustic pavement completed his refurnishing of the choir and sanctuary, begun in 1847 (see p.20). The brass to Prior Crauden, 1341, was renewed in its original matrix and contains the kneeling figure of the Prior. The nineteenth-century slab to Bishop Hotham, d.1337, marks the site of his burial.

The north choir aisle contains the Tournai marble tomb slab, possibly to Bishop Nigellus, 1169, one of the first effigial tomb slabs in Britain (Figure 1.20), and many ancient paving slabs and ledger stones. The south choir aisle has a particularly fine sequence of indents and brasses, recently surveyed by the Monumental Brass Society, and an immense black armorial ledger to Bishop Petrus. Brasses to Bishop Goodrich, d.1554, and Dean Humphrey Tyndall, d.1614, are protected by rails. Both ledgers and indents are deteriorating. The paving to both choir aisles has recently been repointed and some badly worn York stone has been replaced.

In the south transept are some fourteenth-century tiles, similar to those in Prior Crauden's chapel in the precinct, which contains an important and complete *opus sectile* tile pavement of the fourteenth century (see p.3). Sixteen of the mosaic tiles were stolen recently and have been replicated by Diana Hall (see Chapter 1).

A.9.1. Floor records

A series of floor plans indicate the position of graves and ledgers at various dates, and the *Record of Restoration* by J. Bacon (1871), Clerk of Works to Gilbert Scott contains detailed accounts of floor restoration and of the movement of ledgers and brasses. All inscriptions were recorded recently and floor plans marked and updated. *Paving, the Way Forward*, a thesis by Duncan Boddy (1994; unpublished) contains a detailed historical account of the floors.

A.10 Exeter Cathedral

Exeter is remarkably rich in medieval ledger stones which, together with its medieval effigies, gives its floors an unusual importance. Some ledgers were moved in 1763 when the choir was repaved and the Dean and Chapter decided that 'the old grave stones that were taken up in the quire be laid down in the body and aisles of the church at such places as may want repair'. Dean Milles recorded in 1764 'While this old pavement was removing . . on ye removal of ye great stone at foot of ye communion steps on which the effigy of a Bishop is cut, and which has always been called Bishop Bitton's monument . . the workman, putting his hand into the coffin, pulled out a sapphire ring, clumsily set in gold . . at the same time he took out a chalice and patten . . they are both of silver gilt'. They are now in the Cathedral library.

Some of these grave slabs or indents resited in the north choir aisle, have been identified; To Bishop Bitton d.1307, a brass indent (see Figure 1.38); Bishop Brewer d.1244, a sixteenth-century slab with a black letter inscription, recut in 1961 'founder of the church, 1244'; and Bishop Allein 1570. In the south choir aisle lies the indent to Bishop Berkeley d.1327, with, in the centre, the circular matrix for a brass demi-figure in a trefoil.

The chapel of St Andrew and St Catharine contains four large medieval ledgers, and some medieval tiles. In the Lady Chapel lies the coffin-shaped Purbeck marble slab possibly to Bishop Bartholomeus d.1184. The effigy is one of the earliest Purbeck sculptures, a life-size figure (Figure 1.21). Next is the Purbeck effigy to Bishop Simon of Apulia, in higher relief. An incised marble slab with a foliate cross commemorates Bishop Quivil d.1291, under whom the Lady Chapel was finished. The floor is paved with nineteenth-century

geometric tiles. Scott repaved this and the choir in 1870–1877. The handsome encaustic pavement commemorates nine bishops with their coats of arms.

Much of the nave, nave aisles and choir aisles are paved with ledgers, many medieval, a rare survival. There are two brasses, a military brass to Sir Peter Courtenay d.1409 in the south choir aisle and to Canon Langton d.1413 in the chapel of St John the Evangelist.

A.10.1 Floor records

Exeter Cathedral library contains an unusually complete record of floor monuments, including J.W. Hewett, *A Complete Monumentarium of the Cathedral Church of St Peter, Exeter, Vol. 3* (1849) and the Rev. Vyvyan Hope's *Monumentarium* (1956), which records all inscriptions, translating those in Latin and describing the heraldry. A recording team under Dr Payne has updated and computerized the *Monumentarium*, including a complete photographic record of all ledgers. A floor plan of 1757 identifies the position of many of the ledgers.

A.11 Gloucester Cathedral

The Lady Chapel contains many medieval tiles, mixed with ledgers, all recorded in 1890 when the entire floor was relaid on concrete. The intrusive placing of the 1987 font at the entrance is unfortunate. There are also medieval tiles in the north ambulatory chapel, unprotected and at risk.

The nave and aisles were repaved in 1740 under Bishop Benson. The ledgers that survived this process were lined up between the columns on each side of the nave. These are predominantly black Purbeck ledgers dating from the eighteenth century, several with armorials, and many with foliate decoration.

In the north transept lies a large medieval indent with a marginal inscription, and a medieval ledger with a black letter inscription. There are also fifteen armorial ledgers in black Purbeck.

The fine pavement of marble sgraffitto designs and encaustic tiles in the choir and presbytery was designed by Sir Gilbert Scott, 1869–1873. In the sanctuary the medieval tiled pavement of Abbot Seabroke, 1455, is still largely in situ in front of the high altar.

A line of ledgers, mostly eighteenth century, and damaged, continues all round the centre of the cloister pavement. They were relaid, on a concrete base, in c.1855 (Welander, 1991).

A.11.1 Floor records

The Lady Chapel ledgers, with inscriptions, decoration and arms, were recorded c.1890. *An Original History of the City of Gloucester* by T.D. Fosbrooke (1819), contains a complete list of ledgers with inscriptions. *The History of the Art and Architecture of Gloucester Cathedral* David Welander (1991), and *Gloucester Cathedral* by David Verey and David Welander (1979) both contain information on medieval tiles. A full list of legible inscriptions and locations was completed in 1992. There is a floor plan by John Carter in the library.

A.12 Hereford Cathedral

The important collection of brasses includes Bishop Frowestours d.1529, and Richard Delamere d.1435, and wife, figures under canopies, in the north transept. Bishop Trillack d.1360 lies in the chancel, a figure under a cusped arch. The encaustic pavements in the chancel and transepts are by Gilbert Scott, and those in the choir possibly by Cottingham. The tiles, made by Godwin, are geometric intersected with bands of stone.

In the crypt is an incised slab to Andrew Jones d.1497 and wife, two large figures under a double canopy, and four defaced stone effigies.

A.12.1 Floor records

Francis T. Havergal, *Monumental Inscriptions in the Cathedral Church of Hereford*, 1881; A.J.

Winnington-Ingram, *Monumental Brasses in Hereford Cathedral*, revised by F.C. Morgan and P.E. Morgan (1972). There is a detailed floor plan but no photographs.

A.13 Hexham Abbey

The nave was rebuilt in 1907 by Temple Moore. A fine fourteenth-century effigy of a knight and his wife lies in the north chancel aisle, a large black slab to Sir Thomas of Delvinstone lies in the centre of the chancel and an early brass in front of the high altar.

Three armorial ledgers lie beside the Acca Cross, and more ledgers are lined up vertically along the slype wall.

A.14 Kirkwall Cathedral, Orkney

During the Mackie Watson restoration of 1913–1930, when much of the floor was repaved, all the ledgers were taken up and fixed as wall monuments along the nave aisles and choir aisles. With bold figures in deep relief, shell and foliage borders and elaborate inscriptions, decorated with skull and cross-bones or putti, they are very fine indeed, as an expression of the local vernacular tradition. There are seventy of them.

The exceptionally fine Norman interior of Kirkwall is largely undecorated. The impact of the splendid array of ledgers encircling the walls is immensely impressive.

A.14.1 Floor records

A booklet containing drawings of the ledgers has been completed recently (Johnston, 1994).

A.15 Lichfield Cathedral

The remarkable tiled pavement of c.1300 in the library was rediscovered in 1987 (see Chapter 2 and Plates 20 and 21). The complete medieval design has been recovered and recorded and a conservation programme has been completed. There is now a viewing platform at the west end of the library and visitors are restricted to this area to avoid further damage. There are also thirteenth-century tiles in the consistory court.

The encaustic tile pavements by Minton in the chancel were designed by Sir Gilbert Scott, based on fragments of medieval tiles found under the chancel floor, excavated in 1852. The presbytery floor contains encaustic tiles with medallions representing events connected with the cathedral, three of them relating to St Chad. The sanctuary floor containing biblical scenes in two-coloured encaustic panels, with tiled borders, was given by Herbert Minton d.1858 (see Plate 19). The complete decorative scheme is one of Scott's best. When the nave was repaved with York stone many ledgers were destroyed.

A.15.1 Floor records

The library possesses a typescript of Grundy-Newman's *Inscriptions and Heraldry* and *Lost Inscriptions and Heraldry in Lichfield Cathedral*, compiled from Shaw's *Staffordshire* (1798), mainly concerned with wall monuments. See Chapter 2 for details of the survey.

A.16 Lincoln Cathedral

The remarkable collection of medieval ledgers, many with marginal inscriptions, the sequence of enormous brass indents along the north and south choir aisles, sixty-four in all, and the array of ledger stones with which much of the angel choir is paved, add an important dimension to this wonderful building. The medieval ledgers are distributed throughout the interior and in the cloisters. Many of the inscriptions are in medieval French or Latin, recently translated and published (Aldritt and Tripp, 1990). The black Tournai grave slab to Bishop Remigius, decorated with a tree of Jesse, dated c.1140, a posthumous monument, is one of the oldest inscribed slabs in England.

Other medieval ledgers lie in the cloisters, not in good condition, some in the south walk displayed on the wall. The finest, to Richard of Gainsborough d.1300 'at one time master mason of this church' has a black letter inscription and a magnificent figure under a triple canopy with angels. A replica is laid centrally on the floor. Thomas Loveden's tombstone, d.1400, appeals 'to Father Giles . . . in you have I trusted; repay my offering soon'. Fine medieval ledgers to the Gilbertine anchorite, John Levison, and Sir William Dymoke d.1533, Chaplain of the Chantry of Sir Nicholas de Cantilupe, have been grouped together.

The splendid brass to Bishop Smith d.1513, Chancellor of Oxford University, was vandalized in the Civil War, but replaced in 1927 by Brasenose College, which he founded. The sixty-four immense black brass indents lie centrally along the north and south choir aisles. Those on which the original figures are distinguishable are noble works of art, and deserve protection. The great bulk of the ledger slabs lie on main pedestrian routes, and are therefore being heavily worn.

The floors of the angel choir and the chantry chapels are virtually covered with ledgers, some of which were moved from the nave when it was repaved in 1790. Many have armorial bearings, with lettering in relief, and many have interesting inscriptions. A rich collection of all periods which creates a superb floor pattern. Outstanding is the ledger behind the high altar to Dean Honywood d.1681. 'Grandchild, and one of the 367 persons that Mary, the wife of Robert Honywood Esq., saw before she died. Lawfully descended from her that is 16 of her own body, 114 grandchildren, 228 of the third generation and the fourth.' On Dean Honywood's monument in the south nave aisle it states that, while Dean of Lincoln, he 'built at his own expense, a library' (the Wren library) 'on the side of the cloister of this church, which had fallen down, he subsequently enriched it with books, neither few nor merely popular'.

A.16.1 Floor records

Gervaise Hollis *Church Notes* (1630s). Bishop Sanderson's *Survey of Cathedral Monuments* (1641). Powell's *Survey of Cathedral Monuments* (1861). *Lincoln Cathedral, Ancient Monumental Inscriptions*, Robert Sanderson (1851), contains many of the inscriptions recorded by William Dugdale in 1641. *Monumental Incised Slabs in the City of Lincoln* by F.A. Greenhill (1986). *Latin and French Inscriptions of Lincoln Minster*, Aldritt and Tripp (1990). A group of NADFAS volunteers recorded all floor inscriptions in 1995–1996.

There are a number of floor plans, including one from Gough's *Camden*, prepared before repaving in 1790, and a floor plan prepared by Michael Drury in 1875, based on Dugdale and Browne Willis, and updated by Robert Godfrey, Surveyor and Clerk of Works, in 1936.

A.17 Norwich Cathedral

Norwich has many Purbeck ledgers and a number of brass indents, including one to Bishop Lyhart d.1422, by the organ screen. He wished to lie under the vaults that he built. An inscribed slab to Bishop Herbert de Losinga d.1119, 'founder of this church', lies in the presbytery. A small group of medieval tiles without any surface, and a nineteenth-century tiled pavement with vine scrolls in the presbytery, designed in 1890 by Sir Reginald Blomfield, are of interest. There are forty ledgers in the north transept, many in the south transept and the ambulatory, chapels and choir aisles. The nave, aisles and cloisters were repaved in 1740–1743, when many of the earlier ledgers were moved or lost. The choir and presbytery were also repaved in 1766–1768. Some ledgers, with armorials and good lettering, have survived, between the nave piers.

A.17.1 Floor records

Repertorium by Sir Thomas Browne (1712), and *The History of Norwich* by Bolmefield (1741), both contain some information on the

monuments and floor slabs, with inscriptions and details of heraldry. A floor survey was carried out by Keith Darby in 1991 identifying eighty-five ledgers with legible inscriptions. Cathedral Camps made a partial record of floor inscriptions in 1990.

A.18 Pershore Abbey, Worcestershire

The Norman abbey was dissolved in 1539, and partially demolished. It was restored by Gilbert Scott in 1862–1865, by Harold Brakspear in the early twentieth century, and by F. Andrew in the 1920s. There were forty-seven ledgers, mostly of the seventeenth and eighteenth centuries, some with interesting foliage decoration, some with armorials, many with good lettering. Unfortunately the nave was repaved and underfloor heating installed in 1996, to the detriment of the small but excellent collection of ledger stones, whose future appears undecided, although important archaeological evidence was uncovered. The new paving is of three contrasted stones, with diagonal quarries and linear borders. Some fifteenth-century medieval tiles survive in the southeast chapel. There are three brasses behind the high altar. The ledgers at the west end have remained in situ.

A.18.1 Floor records

A comprehensive survey of all ledger inscriptions was completed by the Rev. Staines in 1996. Evidence for damaged inscriptions was obtained from Nash's *History of Worcestershire* (1782) and Prattinson's manuscript *Collection of Parishes, Monuments, Inscriptions etc. in Worcestershire* (c.1820), in the Society of Antiquaries Library. The architect F. Andrew recorded the position and names of all ledgers on the floor plans in the 1920s, without inscriptions.

A.19 Peterborough Cathedral

The retrochoir is greatly enriched by many ledger stones, some of the seventeenth and eighteenth centuries, with good lettering. There are a few ledgers in the north nave aisle and chancel aisles, but none in the nave or south nave aisle, owing to repaving in the 1950s. Outstanding is the Cosmatesque pavement in the sanctuary designed by J.L. Pearson, after his rebuilding of the central tower of c.1894. Pearson's rich furnishings provide a foil to the monumental Norman nave. The cosmatesque floor in the choir has been replaced by a modern marble pavement.

Important early marble tomb slabs to four abbots, dating from c.1195 (Abbot Benedict) to c.1225 lie in the south presbytery aisle, with another of similar date in the north presbytery aisle.

A.19.1 Floor records

The Rev. W.D. Sweeting published a *New Guide to Peterborough Cathedral* in 1893 which records all monuments within the cathedral, including ledger slabs and brasses, with locations but without inscriptions. *The History of Antiquities of Northamptonshire* by John Bridges (1791) includes floor plans of the nave.

A.20 Rochester Cathedral

The medieval tiles in the northeast transept have recently been cleaned and consolidated and a small area in the southeast transept is becoming loose. Part of the northeast transept and presbytery were repaved with encaustic tiles during Gilbert Scott's restoration. In front of the high altar lies an exceptionally large matrix of grey marble with an indent of a bishop with a mitre, staff and heraldic devices. The Lady Chapel has the best collection of ledgers, including one of 1759 to Frederick Hill 'who provided for his majesty's sick and wounded seamen at this port', with a delightful relief of the good Samaritan on horseback. The lettering and armorials on many of the eighteenth- and nineteenth-century ledgers in the nave and aisles are very fine.

Nine ancient matrices with brass indents lie in the north choir aisle. The central indent is very large, of a bishop with mitre and staff, shields and canopy, and needs protection. Next lies an indent of a priest, with scrolls, and an indent of two small figures with children. They lie below the effigy of Bishop Hamo de Hythe, 1352, and reputedly on the pilgrims' route to the former shrine of William of Perth. The worn steps leading east from this point have been encased in wood for protection.

A.20.1 Floor records

A complete historical record of repairs and alterations has been completed recently. A record of inscriptions is being carried out by volunteers.

A.21 St Albans Abbey

In the Middle Ages, this was one of the richest religious foundations in England, and consequently very rich in monumental brasses. There are eight brasses and fifteen indents in the presbytery, several of which still retain brass inscriptions and fragments. Exceptional is the indent to Abbot Stone d.1451, by the altar steps, with a brass tripartite canopy and a black letter inscription. Also by the high altar lies the huge matrix from which the brass to Abbot de la Mare d.1396, was removed and remounted in the north presbytery aisle. There is a fine military brass to Sir A. Grey d.1480, two bishops, one with a marginal design of griffins and dragons, one with a marginal inscription, two abbots, and a brass to Robert Fairfax, doctor of music d.1521, with his wife and children, renewed 400 years after his death. Many of these are protected by inadequate mats and have been damaged by chairs.

The north presbytery aisle contains the famous brass to Abbot de la Mare d.1396, made by Flemish craftsmen. The life-size figure is framed by several tiers of saints under canopies. Above, the abbot's soul in a cloth is surrounded by angels.

To the east is a brass to a man and his wife, with a black letter inscription. In the Ramryge Chantry lies an incised slab with the figure of an abbot. There are further brasses and indents in the south presbytery aisle, including a brass of Ralph Rowlatt 1543, merchant of the Staple of Calais.

The great relief tile pavement of c.1165, formerly in the chapter house, was one of the earliest polychrome relief tile pavements in England (see Chapter 1). It was excavated by Martin Biddle in 1979, and the tiles are still crated up, awaiting a decision on their future. The tiles were copied, in the nineteenth century, for the encaustic pavement in the chancel. A small group of medieval tiles lies in the north transept. There are many interesting ledger stones in the nave, nave aisles, transepts and chapels.

A.21.1 Floor records

There are no records of floor inscriptions. A conservation study is being prepared by Peter Burman.

A.22 St George's Chapel, Windsor

The massive royal grave slabs to Edward IV and Henry VI are raised and protected. Not so the ledger covering the royal burial vault of George III, nor the slab marking the burial place of Henry VIII, Jane Seymour, Charles I and a child of Queen Anne in the choir, which are badly scratched. The black-and-white chequered floor also shows signs of wear (see p.20). Some repaving has recently taken place to the west of the choir screen.

A decision was taken some time ago to record the ledgers and to regard them as expendable, but this policy is likely to be reviewed shortly. There are many to Military Knights of Windsor. In 1790 ledgers with armorial crests were lined up along the centre of the north and south aisles, and round the ambulatory, attracting maximum wear, and many are becoming illegible.

The beautiful Bray chantry chapel, containing fine monuments and important ledgers,

has been turned into a shop. After considerable damage had occurred, a timber floor has been installed, and some monuments removed. The overcrowding here is horrific.

The paving in the cloisters is breaking up and some of the brass indents have been skimmed with cement.

A.22.1 Floor records

There is a complete record of floor inscriptions in S.M. Bond *Monuments of St George's Chapel* (1958) showing locations. All ledgers were photographed in 1982. Emlyn's eighteenth-century floor plan shows the position of ledgers before rearrangement in the late eighteenth century.

A.23 St Mary Redcliffe, Bristol

Two of the most important brasses to survive in their original position lie to the west of the high altar steps. To the north lies John Brook, d.1522 and his wife Johanna, daughter of Richard Amerique, after whom America may have been named. John Brook was Servant-at-Law to Henry VIII, Judge of Assize and Chief Steward of Glastonbury Abbey. To the south lie John Jay, 1480, and Johanna his wife, wearing a pedimental head-dress.

The choir is paved with black and white chequered marble. George Godwin laid the encaustic tiles in the nave in the nineteenth century. There are many ledgers in the north and south choir aisles, of the seventeenth and eighteenth centuries.

The most important medieval ledgers lie in the south transept. One, with a marginal black letter inscription is to John Blecker, who endowed a chantry chapel in 1434. Into the ledger the name Lucas Stritch 1716 has been carved. The other, also with a marginal black letter inscription and a dagger and shield, is to William Coke, servant to William Canynge, who paid for building the clerestory and vaults. His effigy lies against the south wall of the transept (see Chapter 1).

There is also an armorial ledger to William Penn 1670, father of the founder of Pennsylvania. His armour is on the north wall of the nave.

A.24 St Paul's Cathedral, London

The magnificent black and white chequered marble pavement covering most of the main floor area was designed by Sir Christopher Wren and drawn, in 1708, by Dickinson (Figures 1.13 and 1.14). It was completed in 1710 and makes a spectacular contribution to this overwhelming interior. It includes, under the dome, an impressive circular pavement, divided into quadrants, with a central star (see Figures 1.15 and 1.16). This is undergoing a phased programme of replacement, panel by panel. The circular brass grilles encircling this area have almost lost the delicate incised decoration of hearts and Tudor roses. The whole floor is suffering from overuse, and a dip is now visible along the central walk of the nave.

The important ledger stones, many commemorating national heroes, are confined to the crypt, and much damage has been inflicted here over the past forty years. Most visitors wish to see Wren's tomb in the south-east aisle, where the most important floor monuments lie. These include ledgers to Robert Mylne and C.R. Cockerell, both Surveyors to the Fabric, John Rennie, George Dance, (lettering recently recut; see Figure 1.28), Sir Thomas Lawrence PRA (inscription now obliterated), Sir Joshua Reynolds PRA Benjamin West PRA, Sir Edwin Landseer, Henry Fuseli, John Opie, J.M. Turner and Holman-Hunt (lettering by Eric Gill). A programme of recutting simple inscriptions on ledgers is progressing slowly. Deterioration of the crypt floors is constantly monitored.

The spectacular collection of nineteenth-century brasses commemorate Sir John Millais and Lord Leighton, both designed by Norman Shaw, Sir Lawrence Alma Tadema, Sir Edward Poynter PRA, Sir Joseph Boehm and Sir Arthur Sullivan, all on black marble slabs with noble

brass lettering and decoration. The mosaic floor round the Nelson monument was designed by F.C. Penrose, for forty-five years Surveyor to the Fabric.

Although entry charges have caused a slight reduction in numbers, there is still serious overcrowding at times. The Building Research Establishment are monitoring wear to the nave floors (see Chapter 13).

A.24.1 Floor records

Dugdale's *Memorials of St Paul's and Westminster Abbey* records inscriptions in old St Paul's, before the fire. Some pre-fire ledgers are in the crypt. A partial record of inscriptions was made in 1890; Lord Mottistone, when Surveyor to the Fabric, prepared a floor plan of all grave slabs in the crypt. There is a floor plan of the crypt, on which all ledgers have been entered. All inscriptions have been recorded and photographed recently.

A.25 Salisbury Cathedral

The octagonal inlaid tiled floor in the muniment room of c.1260 is one of the best-preserved medieval pavements in Europe (see p.6 and Plate 3). The tile carpet is composed of Wessex tiles, in parallel strips radiating from the central piers. The individual tile designs include lions, griffins, birds and fleurs-de-lys, comprising altogether fifteen different designs. The protective wooden floor was temporarily removed in 1995 for recording and repairs. There is also a group of re-set medieval tiles, possibly from the original chapter house floor, flanking the old altar position in the chapel at the east end of the north presbytery aisle

The exceptional brass to Bishop Wyville is in the northeast transept. The bishop looks out from a fortress representing Sherborne Castle, recovered for the cathedral from the Earl of Salisbury (see p.33). A copy for rubbing lies in the north nave aisle. A brass to Bishop Edmund Gheast d.1577, with a black letter inscription, and one to Thomas Whyte d.1588 are nearby. All are suffering from wear.

There are many interesting ledger stones with fine lettering, some of them armorial, in the nave aisles and transepts and at the west end of the nave. Wyatt moved many effigies and tomb chests from the demolished Hungerford and Beauchamp Chapels to positions between the nave piers.

The two remarkable effigies in the south aisle are from Old Sarum. Bishop Roger d.1139, lies on a Tournai marble slab, with a flat leaf border. He has a crozier and a fourteenth-century replacement head. The other, on a Purbeck marble slab with a marginal inscription, is attributed to St Osmund 1078–1099, although the effigy and lettering date from the twelfth century.

The impressive chapter house pavement, reputedly a copy of the medieval floor, recorded by Shaw, was laid under Clutton and Burges in 1855–1856 (see p.10). It is showing signs of wear. The encaustic pavement in Trinity Chapel contains patterns based on medieval precedents. The nave, aisles and north porch are paved with a Purbeck and limestone pattern of lozenges and squares, probably laid in 1890. The ugly chancel floor is a replacement of Scott's fine encaustic pavement, taken up in 1969.

A.25.1 Floor records

The recent *Salisbury* volume of the Royal Commission on Historical Monuments for England includes a survey with locations of floor monuments. A photographic record and a list of inscriptions was prepared under the former Clerk of Works, Roy Spring. James Harris' list of *Monumental Inscriptions* compiled in the eighteenth century and T.H. Baker's *Monumental Inscriptions in Salisbury Cathedral* (*Wiltshire Gazette, 1927)* both contain some floor inscriptions.

A.26 Southwark Cathedral

Despite the fires, the dereliction of the nave, and the rebuilding by Sir Arthur Blomfield in

1890–97, many ledger stones survive in the transepts, and two patches of Roman mosaic, moved to the north choir aisle from the graveyard.

The retrochoir, used as a pig sty until 1832, contains most of the ledgers from the nave and chancel. They mostly date from the seventeenth and eighteenth centuries, and almost completely cover the floor. Many commemorate interesting characters and provide a good source of information on local history.

A.27 Southwell Minster

Much of the floor, including the nave and central crossing, was repaired during the restoration by Ewan Christian in 1880–1890.

Some ledgers were reset during this repair (see Chapter 9). There is a sequence of interesting ledgers, some with brass inlays, in the south transept. The floors have been recorded recently, and included in the Cathedral inventory. All the inscriptions have been recorded and photographed.

A.28 Tewkesbury Abbey

The floors here are wonderfully rich; so are the monuments. There is hardly any part of the floor that is not covered with medieval tiles, ledger stones or encaustic pavements, all of very high quality indeed.

The medieval tiles in the founder's chantry chapel are in remarkable condition and appear to retain their original tile carpet. There are also medieval tiles, in the south aisle, the Beauchamp Chapel, and the south choir aisle, resited. The ledgers covering the floors of the main church and many of the chapels have excellent lettering, some with armorials and foliage decoration.

Those in the nave are covered with coir matting and chairs, and therefore inaccessible. The floors are maintained to a high standard but matting tends to accumulate grit and needs frequent cleaning if it is not to become abrasive. The ledgers have been treated with a water-based polish, since removed, which has caused problems of rising damp.

Scott's spectacular pavements enrich the choir, presbytery and sanctuary. The colours are confined to red and cream, intersected with bands of black. Designs taken from medieval tiles include coats of arms of great families connected with the Abbey. Also fleurs-de-lys, vine leaves, Tudor roses, bears, eagles and heraldic lions.

In the sanctuary Scott has incorporated brass plaques commemorating the burials of Gilbert de Clare, killed at Bannockburn 1314, Hugh Despenser d.1327, and his son Hugh d.1348, responsible for much of the remodelling of the abbey, and Sir Edward Despenser d.1375, standard bearer to the Black Prince at the battle of Poitiers. The huge matrix to Maud de Burgh d.1315, with the brass indent of a life-size figure under a canopy, is incorporated in Scott's sanctuary pavement. Edward Prince of Wales d.1471, is commemorated in the choir, and the Duke of Clarence d.1477, brother of Edward IV, behind the high altar. The tiles are regularly varnished with a water-based emulsion, and buffed up with a large floor polisher, effective in the short term, but not recommended owing to possible long-term damage by rising damp. Once a year the floor is washed to strip off the old polish.

A.28.1 Floor records

Many of the archives are in the Cambridge University library. *Tewkesbury* by Dr John Blunt contains information on the monuments. Incomplete records of some inscriptions were compiled sixty years ago; a further floor survey is proposed.

A.29 Truro Cathedral

Largely designed by John Loughborough Pearson, whose statue stands above the south porch, and built from 1880. Pearson's Cosmatesque marble pavements are in the

choir and sanctuary. On the baptistery floor is a radiating design in richly contrasted marbles, while the aisle, transept and nave floors are of patterned terrazzo.

A.30 Wells Cathedral

One of the earliest incised grave slabs in England, to Bishop Bitton d.1274, lies in the south choir aisle. The figure, under a trefoiled gable, lies on a coffin shaped slab, and is protected by a polycarbonate cover. To the north of the crossing lies a large and splendid lias indent of a lady beneath a canopy, wearing a high mitred head-dress, probably to Joan de Cheddar, wife of Viscount de Lisle d.1464. Another indent of a figure, also framed with a canopy, is probably to Bishop Walter de Haselshaw, d.1308. Two more brass indents lie near the pulpit, both of priests, and a Doulting slab to Bishop Knight d.1547 marks his burial beneath the superb pulpit that he paid for. Nearby is a floor slab to Ina Rex 686–710, founder of the Cathedral. An indent of Bishop Erghum d.1401 is of a figure with a mitre, crosier and canopy.

The retrochoir, north and south chancel aisles and nave aisles are very rich in ledgers, many of them heraldic, some with the inscriptions framed by an arch supported on classical columns, an attractive regional variant. They are mostly of lias or Purbeck and commemorate many interesting local characters, including the Linley family. Protective mats at all entrances, pads on all chairs, and careful control over the placing of furniture, would help to mitigate the damage to these important floors.

The flooring is largely of Doulting slabs, with reconstructed stone in the centre walk of the nave. The cloisters were repaved in the 1960s, when many burial vaults were filled, and ledgers removed. A few defaced ledgers remain, and further grave slabs are located in the cloister garth. The deeply worn chapter house stairs of 1255–1290, one of the most renowned features of the Cathedral, continue to present safety problems (see Chapter 2).

A.30.1 Floor records

Wells has a record of many of its floor inscriptions in A.J. Jewers' *Wells Cathedral: Its Monumental Inscriptions and Heraldry* (1892). A revision by Linzee Colchester d.1990, former librarian, is being completed by the present librarian. It contains inscriptions, heraldry and locations. Many of the inscriptions recorded by Jewers have now been obliterated. There is a floor plan of the cathedral, on which ledgers will be located - work is in progress.

A.31 Westminster Abbey

These floors are amongst the most important in Britain. They include one of the finest surviving thirteenth-century tiled floors; the most outstanding Cosmati pavement north of the Alps; an astonishing sequence of effigies and ledger stones commemorating burials dating from the Saxon kings to the present day; and exceptional monumental brasses. These add another dimension to the splendours of the building and of its monuments (see Chapter 1).

Odoricus, a Roman Cosmati craftsman, was responsible for the great pavements in the sanctuary and the feretory, and for the decoration on the tombs of Edward the Confessor and Henry III. The materials included green and purple porphyry and giallo antico, re-used from classical ruins in Rome, Islamic coloured glass possibly from Venice, and a central onyx from ancient Egypt. The Lombardic brass letters stated the date, 1268 (actually 1272 less 4), the craftsman Odoricus, the patron Henry III, and Abbot Ware. The composition centres round the quincunx, a figure 5, surrounded by guilloches, rectangles and lozenges, infilled with mosaic, and is composed of over 30 000 tesserae. It was designed to lead the eye up to the glories of the high altar.

The matrix, of Purbeck marble, restored in the later seventeenth century and by Scott in the nineteenth century, is in poor condition. The floor is also very dirty. Scott laid a new

Cosmatesque pavement in 1868 on the high altar dais. It includes marbles supplied by Dean Stanley's brother-in-law Lord Elgin, including three large roundels of purple porphyry sawn from an antique column. In 1996 a survey was carried out (see Chapter 3) prior to expert conservation, after which there is hope that it may be left uncovered permanently. Around the shrine tomb of Edward the Confessor is another Cosmati pavement, also laid in 1268. It is set in Purbeck marble and very worn, has been completely covered for many years and was recently uncovered and the shrine area closed to the public.

The chapter house retains the magnificent octagonal tiled pavement, completed for the dedication ceremony in 1258. The tiles, made in the royal tileries, are arranged in parallel strips, the patterns 'most noble in their design and of extraordinary delicacy and refinement' (Scott, 1863). They include the royal arms, a king, a queen, an abbot, an archer, a horseman, a border of pike, and a rose, similar to the design of the thirteenth century rose window. There is also a late thirteenth-century tiled pavement in situ in the muniment room, further medieval tiles in the chapel of St Faith and some thirteenth-century tiles in the shrine area. The microcrystalline wax applied to the chapter house tiles, and the peripheral carpet, have both failed to protect the tiles. The wax has been removed (1997) and a new carpet is proposed.

The impressive black and white chequered marble pavement in the choir was laid in the 1690s to commemorate Dr Busby, headmaster of Westminster School. The chequered marble pavement in the Henry VII chapel was first laid in 1699, possibly under Wren, and the area over the royal burial vault relaid in 1737 (Cocke, 1995). It contains many Hanoverian grave slabs.

There are brass indents in the north ambulatory to Sir Thomas Parry d.1560, and to two monks, Robert Humphries d.1509, and Thomas Brown d.1513, and brasses to Sir John Harpenden d.1438, a knight in armour, and to Abbot Easteney d.1498, who completed the roofing of the nave. He lies, in abbot's robes, under a tripartite gable. The fine brass to Eleanor Duchess of Gloucester d.1399, dressed in widow's dress under a tripartite canopy, and to Robert Waldeby, Archbishop of York d.1397, a figure under a single canopy, lie in the chapel of St Edmund. He was a friend of the Black Prince. A small military brass to Sir Humphrey Stanley d.1505, who 'fought bravely for Henry VII at Bosworth Field', lies in St Nicholas Chapel. There are two immense brass indents in the south ambulatory to Abbot Richard Harvendon d.1441, and Sir John Golofre d.1396 – a cracked Purbeck slab. Part of this brass is in the muniment room. Also to Ralph Seby d.1420, a learned monk, and to Thomas Bilson d.1616, Bishop of Winchester. King Sebert d.616, founder of the abbey, is reputed to lie under an arched recess in the north-west corner of the south ambulatory. The damaged brass to Bishop John de Waltham d.1395, in the shrine chapel of St Edward (beside Edward I's tomb) is covered by the protective floor. He was Lord Treasurer to Richard II, and lies in his mass vestments.

A group of important nineteenth-century brasses lie centrally in the nave; Sir Charles Barry, designed by Bodley; Sir George Gilbert Scott designed by Street; J.L. Pearson designed by W. D. Caroe, all surveyors to the fabric. Caroe also designed the brass to G.E. Street. A splendid figure brass to Robert Stephenson, designed by Scott lies nearby, all damaged by being on the main tourist route. The brass to Lord and Lady Mountbatten by Christopher Ironside, laid in 1985 near the west door, is already showing signs of wear.

In the choir aisles some fragments of the thirteenth-century Purbeck marble floor still survive, though much repaired and cut through by later burials. The burials, with which the Abbey was entirely filled by 1850, are recorded by a range of ledger stones commemorating public figures over 700 years. The lettering on the medieval ledgers has been largely obliterated. Abbot Ware d.1283, and his successor, Abbot Wenlock d.1307 lie under the

Great Pavement. Other medieval grave slabs are recorded on floor plans. The north and south ambulatories are particularly rich in early ledger stones.

The many outstandingly important royal burials are around the shrine of St Edward the Confessor and in the Henry VII chapel, all well-documented.

The north transept contains the burials of many prime ministers and politicians of the eighteenth and nineteenth centuries with associated monuments. Leading scientists are grouped in the north nave aisle; musicians in the north choir aisle. Poets, authors, actors and musicians lie in the south transept while new ledgers, designed by leading craftsmen, commemorate twentieth-century artists. Architects, clerks of works, carpenters and plumbers of the abbey lie in the south and west walk of the cloisters, and deans, organists and abbey officials in the north walk. The ledger to Aphra Behn (a seventeenth-century lady playwright) lies at the foot of the ramp in the northeast corner of the cloister, and is consequently being terribly worn, although recut within the past ten years. Effigies to abbots of the twelfth and thirteenth centuries lie in the south walk of the cloisters. One, Abbot Lawrence d.1173, obtained the canonization of King Edward. Abbot Crispin d.1117, is the oldest effigy in the Abbey. Abbot Humez d.1222, saw the building of the Lady Chapel under Henry III. All are unprotected and in an appalling condition.

There has been some recutting and replacement of badly worn ledger stones. Those to Telford and Herschel have been replaced in cast iron and brass. The ledgers to Thomas Gayfere and Ben Fidoe, clerks of works, were recut in 1995 to commemorate Gayfere's restoration of the Henry VII chapel under James Wyatt, and the completion of the recent programme of repair under Donald Buttress. Further recutting is planned. The deterioration of the floors continues, however, accelerated by the pressure of visitors.

A.31.1 Floor records

The History and Antiquities of St Peter, Abbey Church of Westminster, Neale and Brayley (1823), records many inscriptions, now vanished. Lawrence Tanner, Librarian, in the 1930s prepared notebooks, never published, updating some of these records. *The Historical Memorials of Westminster Abbey* by Dean Stanley (1870) contains detailed information about burials, confirmed by opening up some of the graves. *The Official Guide to the Abbey* (1988), first compiled in 1885 by two daughters of Dean Bradley and inspired by Dean Stanley's publication, has been revised by the former Keeper of the Muniments, Nicholas MacMichael, and former Librarian Enid Nixon. It contains much valuable information on floor monuments, supplemented by the ICOMOS *Cathedral Floor Damage Survey* (Fawcett, 1991). *Patterns of Thought* by Richard Foster (1991) contains a very detailed account of the Great Pavement. *900 Years; the Restorations of Westminster Abbey* by Thomas Cocke (1995) contains some references to floors.

A.31.2 Floor plans

Dean Stanley, in 1870, commissioned floor plans showing the position of all burials, ledgers and brasses, and these have been updated recently.

A.32 Winchester Cathedral

The medieval tiles in the retrochoir of c.1235 form one of the most important spreads of floor tiles in the country. Large areas of the original tile carpet have survived and a conservation programme has been completed (1996) (see Chapter 12). In the north and south retrochoir aisles medieval tiles are mixed with ledgers. The north presbytery aisle was relaid with replica tiles by Professor Baker in 1969. The surviving medieval tiles were then stored, and some have been re-used in the recent repair programme in the retrochoir. Some

replicas by Diana Hall have also been introduced. It is of some concern that, since the repairs were competed in 1997, the public are once again permitted to walk on these outstanding floors. If this continues the tiles, which are extremely vulnerable, may be destroyed.

Winchester also contains an important collection of heraldic ledger stones, in both aisles of the nave, in the nave itself, and at the east end of the retrochoir aisles. A handsome group of black marble ledgers lies in the nave, with distinguished lettering and armorials. The ledger to Jane Austen lies in the north nave aisle, and to Izaac Walton in a side chapel of the south transept.

A.32.1 Floor records

Medieval tiles were recorded by C.J.P. Cave (c.1940s). A record of ledger inscriptions and locations was made earlier this century. All the ledgers have been recorded by rectified photography; the record is in the cathedral library. An archaeological floor plan was made by John Crook in 1990.

A.33 Worcester Cathedral

Although some of the rich collection of medieval tiles has been obliterated by wear and tear, important areas survive. The balcony above the cathedral parlour is tiled, as is the old Custos's office. The new Custos's office, formerly the old music library, is also tiled. The northwest transept has a group of tiles, and some survive at the bottom of the stairs leading from the north choir aisle to the Lady Chapel. Most of these are unprotected.

The nave was repaved in 1756, when many of the ledger stones were moved to the north and south choir aisles. The nave and aisles were splendidly repaved by Gilbert Scott, using Kilkenny black and Sicilian white marble, with a bold Greek key fret design, and chequered borders. Most of the surviving ledgers were then moved down to the Norman crypt.

There are several medieval effigies, some seventeenth-century ledgers and brasses of the eighteenth and nineteenth centuries. Worcester is very rich in monuments and tombs. Bishops Sampson d.1112 and Theophilus d.1123 are commemorated by nineteenth-century inscriptions by the chancel steps. The coffin-shaped ledger to Bishop Henry Wakefield d.1395 was renewed in 1910 with a cross, a crozier and armorial shields. It lies at the west end of the nave. In the sanctuary lies an unusual Gothic black letter ledger to the Duke of Hamilton, killed at the battle of Worcester in 1651. Miserimus (Thomas Morris), a minor canon d.1748, who was deprived of his living for refusing to take the oath to William and Mary, lies at the entrance to the cloister.

The chancel was completely furnished by Gilbert Scott, and the tiled pavements make an important and suitably rich contribution. The tiles, laid in 1872, are of geometric and foliage designs incorporating shields of the diocese, fleurs-de-lys, leopards, peacocks and fish, divided by bands of marble. The sanctuary contains tiled roundels portraying seated prophets.

A.33.1 Floor records

Many inscriptions were recorded in 1986. A floor plan with locations was made by Harold Brakspeare in 1920. A survey of all floor inscriptions was completed by volunteers from NADFAS in 1993.

A.34 York Minster

The Dean and Chapter generously set up a working group in 1991 to devise a methodology for recording and protecting cathedral floors (see Chapter 6).

Many of the ledger stones were destroyed or moved when the nave, aisles and transepts were repaved to a classical design by William Kent and Lord Burlington, in 1731–1738 (see Chapter 5). The design was repeated in the choir, repaved between 1991 and 1994. Many

interesting ledgers survive in the Lady Chapel and north and south choir aisles.

There are also two fine modern slabs, one under the central crossing, commemorating the repair programme to the central tower under Sir Bernard Feilden, and one in the south transept commemorating the repairs after the disastrous fire under Dr Charles Brown.

In the north choir aisle is a brass to the Earl of Carlisle, 1684, and in the south choir aisle to the Earl of Strafford, 1687. There is a nineteenth-century tiled pavement in the chapter house.

A.34.1 Floor records

The RCHME volume on *York* records all inscriptions of ledgers and brasses in the Minster, with photographs. A NADFAS team has completed a detailed record of floor inscriptions with locations. The Minster library contains several historical floor plans and extensive records (see Chapter 5).

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Glossary

Accretia	Additions.
Ambo	A stand raised on steps and used for reading the gospels in medieval Italian churches. Replaced by the pulpit after the fourteenth century.
Ambulatory	Walkway behind the high altar, usually round the apse.
Anthemion	Classical ornament, an interpretation of a honeysuckle.
Baldachino	A canopy above an altar, normally supported on columns.
Bimetallic corrosion	The interaction of two metals causing a chemical reaction.
Byzantine	Ecclesiastical style influenced by early Christian buildings from Byzantium.
Cartouche	A tablet in the form of a scroll containing an inscription.
Champlevé	Enamel work in which different colours are placed in hollows sunk in the surface of the metal.
Chancel	The east end of the church where the main altar is placed, often applied to the continuation of the nave east of the crossing.
Chevet	The area behind the high altar, encircling the apse, often leading to apsidal chapels.
Chinoiserie	Decoration influenced by Chinese motifs.
Choir or organ screen	Ornamental screen separating the chancel from the western part of the church.
Cipher	An heraldic crest, often the coats of arms of the owner inlaid into marquetry or marble floors.
Clerestory	The upper gallery of a cathedral or church.
Cloister garth	The enclosed area in the centre of a cloister.
Coffered	Applied to ceilings with recessed panels (see Compartmental).
Coir	Matting made from coconut fibre.
Compartmental	Divided into compartments. Often applied to ceilings.
Cosmati floors	Marble and mosaic floors made from materials salvaged from classical ruins, designed by Roman marble workers known as the Cosmati, between the twelfth and fourteenth century, mostly in Italy.
Cosmatesque floors	Marble floors resembling Cosmati work but not designed by the original Roman Cosmati families.
Cusp	Point formed by the foils within the divisions of gothic window tracery. Also found as an edging to the gothic arches of tombs.
Custos	Head verger.
Denkmalpflege für Schlosse, Garten und Seen	German state organization for the care of historic buildings, monuments, parks and gardens.
Doge	Chief magistrate of the Venetian republic.

Duomo	Cathedral.
Ecclesiological Society	Formed in the 1840s by the Cambridge Camden Society, they promoted the restoration and re-ordering of churches to conform with their precepts of the ideal middle pointed style. Internally they required raised and stalled choirs and gothic furnishings, which led to the revival and manufacture of encaustic tiles, brasses and ledger stones and the destruction of many medieval floors.
Effigial	Resembling an effigy, often applied to a coffin lid or slab decorated with a figure in low relief.
Effigy	A recumbent sculptured portrait of the deceased, often lying on a tomb chest.
Emblemata	A term applied to mosaic cartoons painted on canvas to which the tesserae were fixed.
Encaustic tiles	Nineteenth-century term for glazed and decorated clay tiles hardened in a kiln.
Enfilade	A series of rooms opening off each other, often leading to the most important room, the throne room or the state bedroom.
Etruscan	Pre-Roman civilization established in Etruria, north of Rome, from before 600 BC. Famous for their pottery, jewellery and wall paintings, they gave their name to a form of classical decoration popular in the eighteenth and nineteenth centuries.
Europa Nostra	European association of conservation organizations.
Felspar	A mineral consisting of silica, potash, soda or lime found in granite and porphyry.
Feretory	The area where the principal shrine is situated behind the high altar.
Fictive cube	A classical design composed of cubes arranged geometrically to simulate a 3-D effect. There are many variants of this design, popular from the sixteenth century for churches and important secular buildings.
Flags	Paving stones, laid sometimes in patterns, usually set in mortar to create hardwearing floor surfaces.
Fleurs-de-lys	Element used in heraldry and in tile design derived from a lily or iris.
Fleuron	Carved flower or leaf.
Floor cloth	Cheap form of floor covering made of painted canvas, imitating carpet or mosaic designs, popular in the eighteenth and nineteenth centuries.
Foil	Lobe formed by the cusping of a circle. Trefoil = three; quatrefoil = four; cincquefoil = five.
Foliated	Decorated with leaves.
Giallo antico	Ancient yellow stone used in Cosmati pavements.
Gobelin	Name of royal tapestry factory in Paris.
Granite	A rock composed of quartz, felspar and mica.
Greensand	Neutral soil, supporting a wide range of cultivated plants.

Griffon (or griffin)	An heraldic beast, a cross between a bird and an animal.
Guilloche	Two interweaving bands forming the letter S, used as a border in *opus Alexandrinum* floor designs.
Herringbone parquetry	Strands of thin wood, usually oak, arranged in parallel strips to create diagonals in alternating directions. Also used for brick paths and pavements.
Hypocaust	System used by Romans to conduct warm air for underfloor heating.
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property, in Rome.
ICOMOS	International Council on Monuments and Sites. Headquarters in Paris, world-wide professional membership. Dedicated to the promotion of expertise in conservation, and to the management of world heritage sites.
Indent	The term used to refer to stone or marble coffin lids or slabs, which still retain the imprint of the monumental brass, since removed.
Ingrain carpet	Carpet without a pile, reversible.
Intramural burial	Burial within the interior of a church. Literally 'between walls'.
Ironstone	Sandstone containing, and coloured by, a high proportion of iron.
Jowllo	Medieval term for yellow.
Key fret	A Greek key geometric design often used for the borders of marble and parquetry floors.
Labyrinth	A maze.
Latten	The metal composed of copper and zinc from which monumental brasses were made.
Ledger stone	An inscribed stone slab to commemorate the deceased, often used to close the grave.
Lias (blue)	Rock strata lying at the base of the oolitic series.
Loggia	A covered porch or gallery outside a building.
Lombardic lettering	Medieval letter forms, used for inscriptions on medieval ledger stones and monuments.
Lozenge	Diamond shaped floor inserts, often of white marble, containing inscriptions.
Marmorani Romani	Medieval Roman Cosmati craftsmen
Marquetry	Decorative inlay work of contrasting coloured woods used for furniture and floors.
Matrix	The stone or marble base into which a monumental brass was fixed.
Microcrystalline wax	Transparent wax composed of small crystals.
Monumental brass	Made from an alloy of copper and zinc, the brass was set into a stone slab to commemorate the deceased. It often took the form of a portrait.

Mortar	A mixture of lime and/or cement, sand and water, used for jointing and bedding stone, brick and marble floors.
Mosaic	Floor composed of small tesserae of marble or coloured stones fixed in mortar and arranged to form geometric patterns or figured designs.
Mosaicist	Mosaic designer.
Muniment room	For the storage of archives and manuscripts.
Musivarius	Term applied to a mosaic worker.
Muskat	Word derived from mosque, applied to imported carpets.
NADFAS	National Association of Decorative and Fine Arts Societies.
Narthex	The enclosed area, often a porch, at the main entrance to a church.
Octagon and square	Used by the Romans to pave streets and floors. Composed of octagons of white stone or marble with lozenges of black marble. Later known as *carreaux octagones*.
Officina	Mosaic worker's studio.
Ogee	An architectural moulding enclosing an arch with a double bend, as in an 'S'.
Oolite	A granular form of limestone, composed of calcites or shell fragments.
Opus Alexandrinum	Marble and mosaic floors of geometric designs composed of guilloches, roundels and rectangles. Term applied to Cosmati floors.
Opus sectile	Ceramic floors made up of segments or tesserae of different shapes to form an overall design.
Opus signinum	Roman term for terrazzo floors composed of crushed brick and lime mortar.
Oriel	A projecting bay window supported on brackets or corbels.
Palazzo	Palace.
Paleochristian	Early Christian.
Palmate	Decorative classical motif representing a stylized palm.
Parquet de Versailles	Oak flooring adapted from a design by Serlio and composed of squares infilled with interwoven diagonals. Originating at Versailles, these floors were first introduced into England by Queen Henrietta Maria at Somerset House in 1661–62.
Parquetry	Flooring made of differently coloured woods arranged in geometrical patterns.
Paviours	Paving stones.
Pebble mosaic	Arrangement of coloured pebbles in contrasted colours fixed in mortar to form a geometric or figurative design.
Pediment	A segmental or triangular head over a classical door opening.
Pennant sandstone	Dark grey stone.
Perspex	A transparent acrylic thermoplastic material.
Piano nobile	Principal or first floor.

Polycarbonate	A transparent material composed of salts of carbonic acid, used as a protective floor covering.
Porphyry	A hard igneous rock containing crystals of felspar, mined in the Middle East, including Egypt. Usually red or green.
Presbytery	The part of the church east of the choir, in the area of the high altar.
Purbeck	Cream or grey fossiliferous limestone quarried on the Isle of Purbeck, Dorset, which takes a polish like marble.
Putti	Cherubs.
Quartz	A silicate found in granite and other rocks, including flint.
Quincunx	Arrangement of roundels grouped round a central circle to form a figure five.
Quire	Alternative to choir – the area in a church where services are sung.
RCHME	Royal Commission on Historical Monuments for England.
Re-ordering	Term used to describe the rearrangement of church furnishings, often motivated by liturgical or stylistic fashions.
Reredos	Decorated or carved screen behind and above the altar.
Retrochoir	Eastern arm of a church, lying between the high altar and the lady chapel or eastern chapel.
Rosa Persiana	An ancient stone used in Cosmati pavements.
Roundel	A circle, often made of sawn sections of columns when used in Cosmati pavements.
Sacrarium	Area in a church reserved for priests, near the high altar.
Scagliola	Coloured plaster made with fragments of marble and a form of cement, polished to resemble marble.
Segmentatum opus	Floor composed of segments.
Serpentine	A mottled stone containing silicate of magnesium and resembling a serpent's skin in appearance.
Sgraffito	Design scratched on plasterwork.
Shale	Laminated rocks.
Slab	A term often used to refer to a gravestone or coffin lid, often in Tournai or Purbeck marble, sometimes inscribed.
Slip	A soft white or cream clay, inserted into the red clay base of tiles in a pattern previously stamped with a mould while the clay is soft.
Slype	Covered way in a monastic church leading from the cloisters to the transept or chapter house.
Soffit	Underside of a staircase, often decorated with marquetry.
Spandrel	Triangular space between the curve of an arch and the rectangular part enclosing it.
Terracotta	A clay based pottery of a reddish colour, also used for architectural decoration.
Terrazzo	Venetian floor made of chippings of marble laid in mortar and polished when set. Also known as Palladiana, owing to its use by Palladio in many of his villas in the Veneto.

Tessellated	Floor paved with tiles, laid in geometrical patterns.
Tesserae	Small cubes of coloured marble or stone, used to make mosaic designs.
Tilery	Site used for the manufacture of tiles, often medieval.
Tournai	A type of black marble quarried in the Tournai area of Belgium used as a matrix for a monumental brass, or for inscribed ledger stones or slabs.
Tractarians	Applied to a group of nineteenth-century religious reformers, including Pusey and Newman, based at Oxford and committed to high church liturgical reform.
Treads and risers	The steps in a staircase are each made up of a horizontal tread and a vertical riser, the treads often finishing with a nosing.
UNESCO	United Nations Educational Scientific and Cultural Organization.
Verde Egyziano	Ancient green stone from Egypt used in Cosmati pavements.

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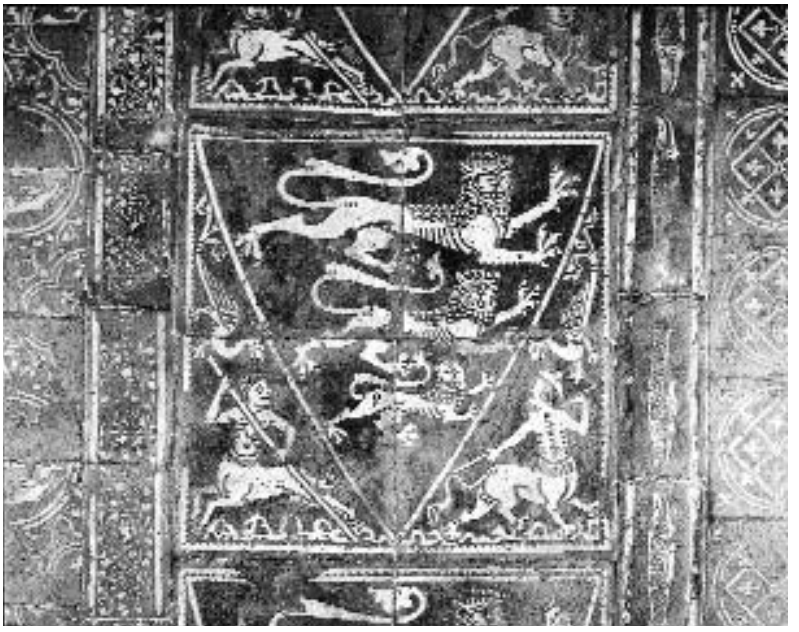


Plate 1 *Westminster Abbey Chapter House. Tile pavement, 1268, restored by Sir George Gilbert Scott, 1866, with some replica tiles by Minton. Detail of Royal Arms. Henry III added the inscription 'as the rose is among flowers, so is this house among houses' (Lethaby's translation) – see page 5 (Photograph, English Heritage)*

Plate 2 *Cleeve Abbey, Somerset. The refectory. Thirteenth-century tiled pavement – see page 6 (Photograph, Jane Fawcett)*

Plate 3 *Salisbury Cathedral. Muniment room. Thirteenth-century tiled pavement detail – see page 6 (Photograph, Jane Fawcett)*

Plate 4 *Salisbury Cathedral Chapter House. Encaustic tiles by Godwin, laid c.1856 during restoration by Henry Clutton and William Burges, replicating thirteenth-century tiles, recorded by Henry Shaw in 1858. Note similarities with thirteenth-century muniment room tiles – see page 6 (Photograph, Jane Fawcett)*

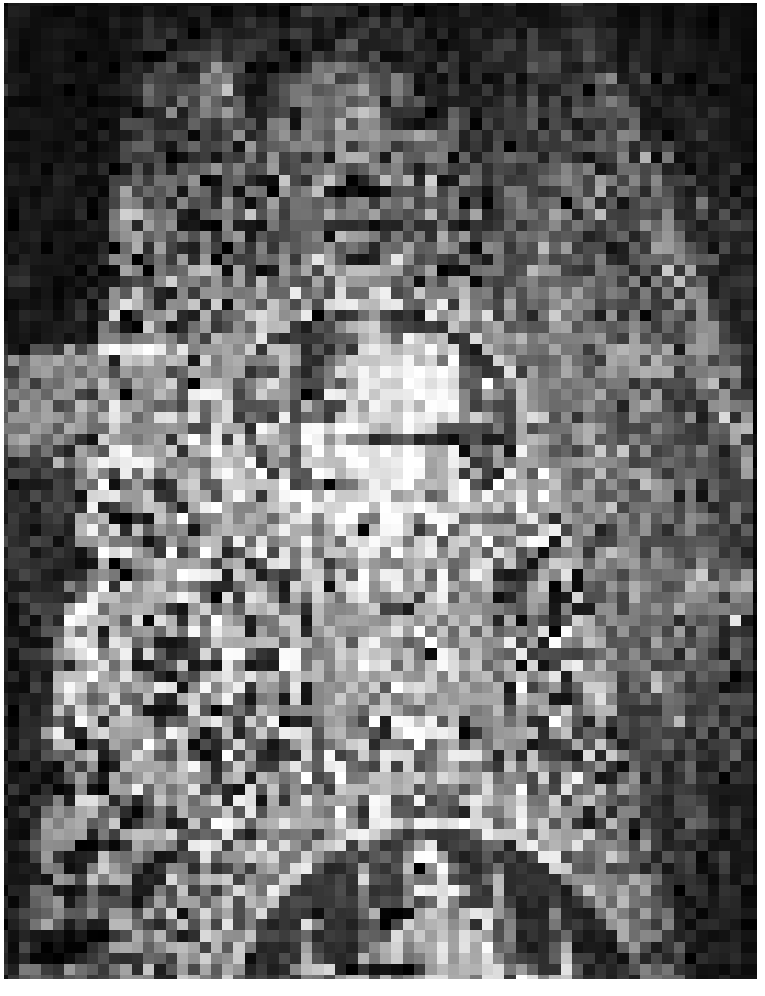


Plate 5 *Worcester Cathedral. Encaustic pavement in sanctuary by Sir George Gilbert Scott, 1873. Tiles by Minton – see page 11 (Photograph, Jane Fawcett)*

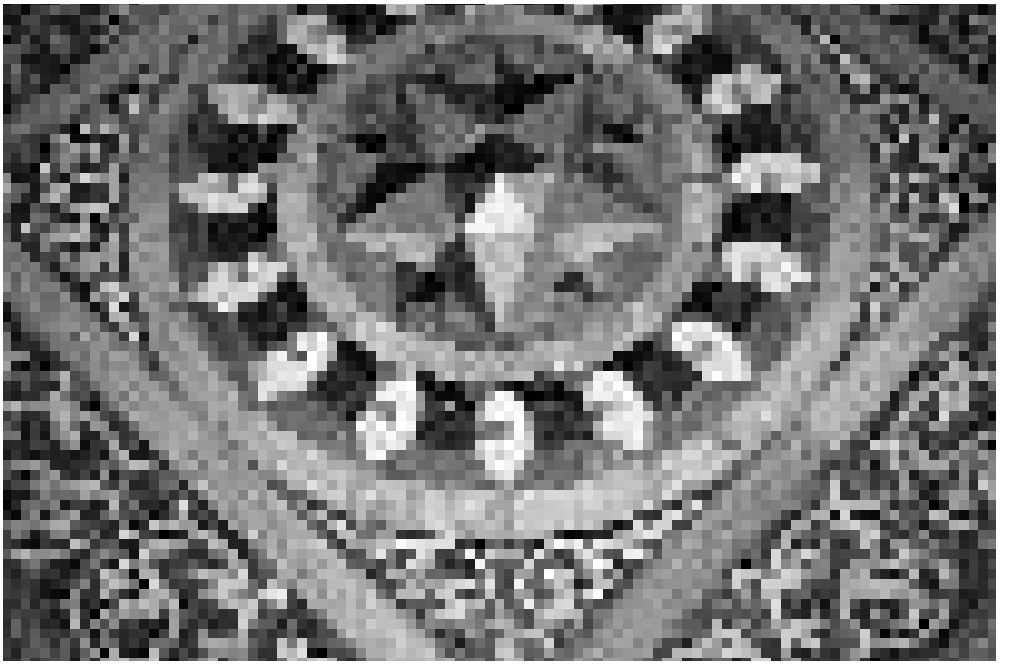


Plate 6 *Basilica of San Marco, Venice, marble and mosaic pavement, eleventh century (restored). San Marco contains the largest surviving areas of mosaic in existence – see page 14 (Photograph, Sarah Quill)*

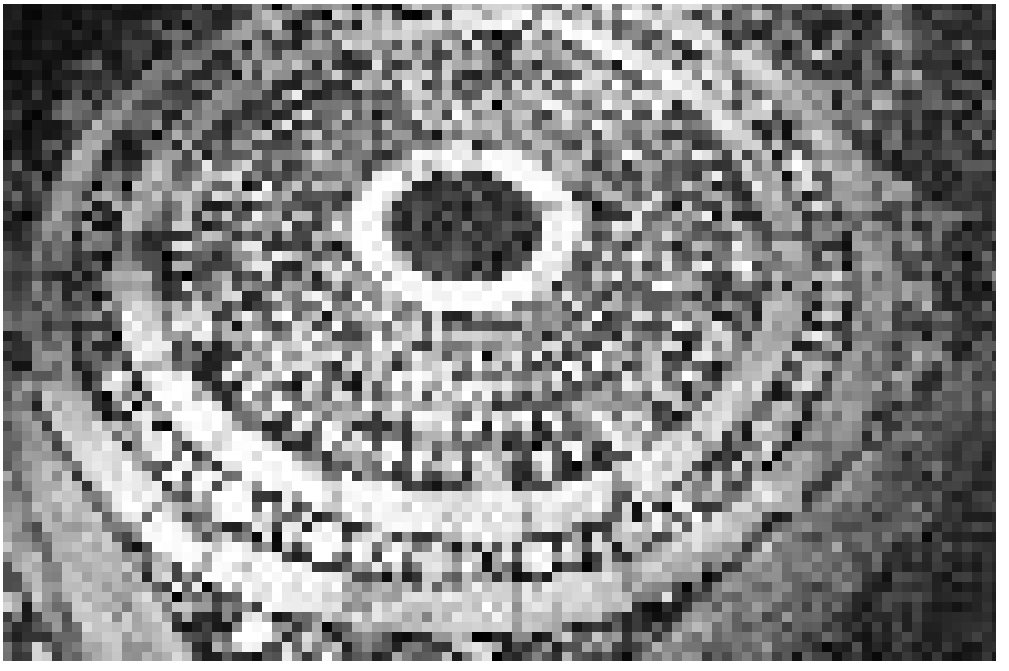


Plate 7 *Cathedral of Santa Maria Assunta, Torcello, Venice, founded in 639 and rebuilt in 864–67. Mosaic and marble pavement, eleventh century – see page 14 (Photograph, Anthony Cleminson)*

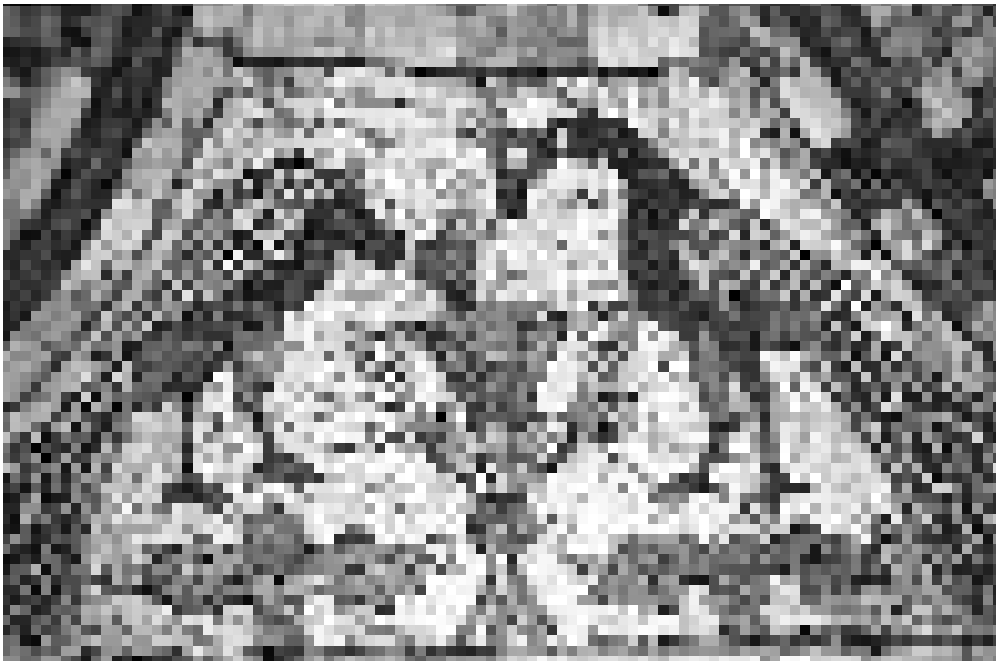
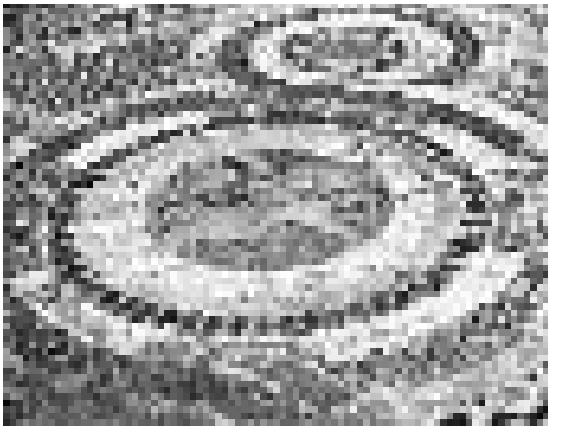


Plate 8 *Cathedral of S.S. Maria Donato, Murano, Venice, founded seventh century. Mosaic of peacocks feeding, 1140 – see page 14 (Photograph, Anthony Cleminson)*

Plate 9 *S. Maria in Trastevere, Rome. Twelfth-century Cosmati pavement, restored in 1866 by Vespigniani – see page 15 (Photograph, Jukka Jokilehto)*

◀ **Plate 10a** *Westminster Abbey, London. The Great Pavement, looking west towards the choir. Completed 1268, by Odoricus, Roman Cosmati craftsman – see pages 15 and 61 (Photograph, Jane Fawcett)*



▲ **Plate 10b** *Westminster Abbey, London. The Great Pavement. Detail of the Central Onyx in the Sanctuary – see pages 15 and 61 (Photograph, Peter Foster)*

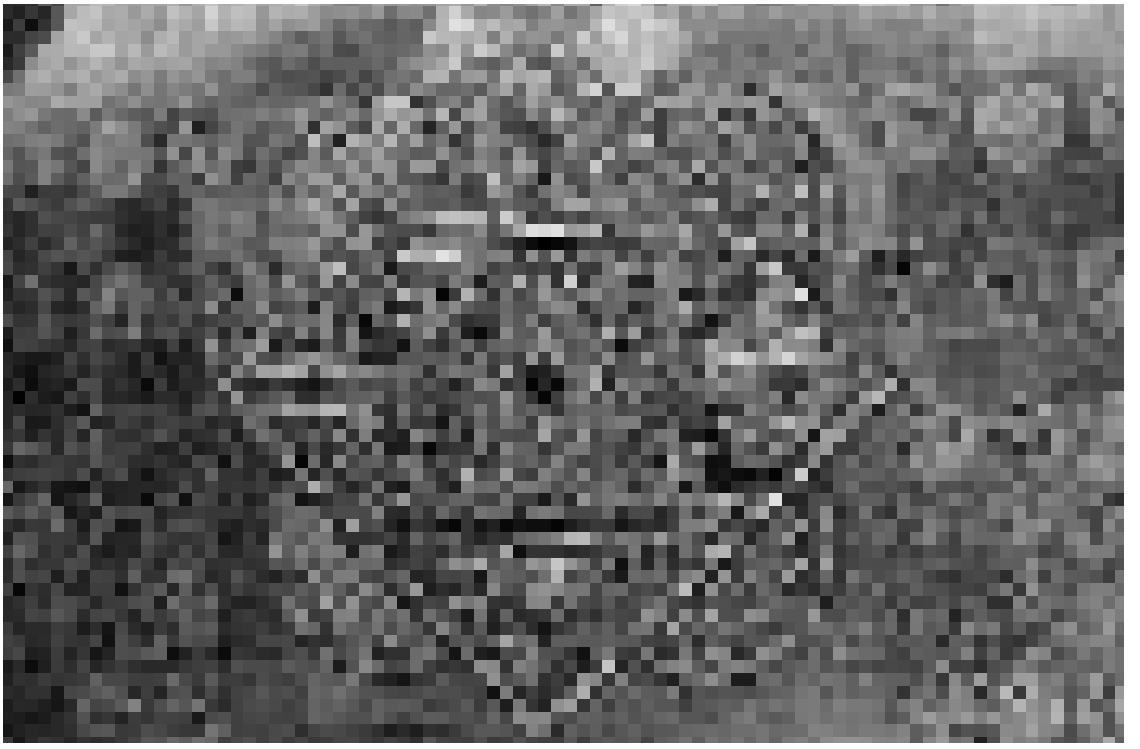


Plate 11 *Opus Alexandrinum pavement in the Trinity Chapel at Canterbury Cathedral. The shrine of St. Thomas was to the east (top) in the figure – see page 16 and Chapter 3 (Photograph, Tim Tatton-Brown)*

Plate 12 *Cologne Cathedral, Germany. The ambulatory, from the triforium, showing mosaic pavements and Maternus Kapelle, with the tomb of Archbishop Philipp von Heinsberg, d.1192 – see page 17 (Photograph, Dombau Archiv, Cologne)*

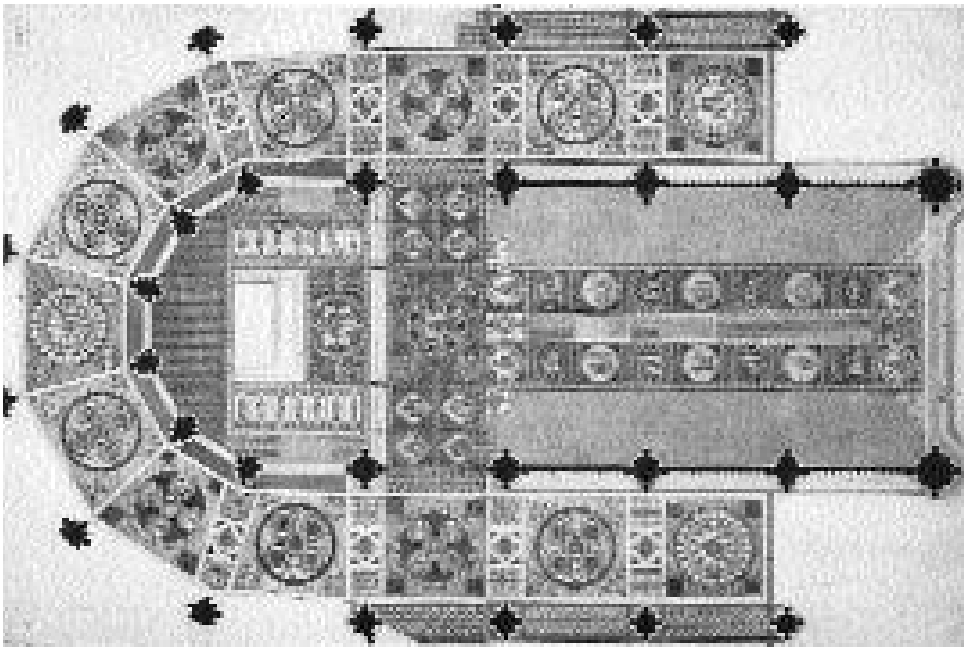


Plate 13 *Cologne Cathedral, Germany. Floor plan, showing arrangement of mosaics by Auguste Essenwein, 1885 – see page 17 (Photograph, Dombau Archiv, Cologne)*

Plate 14 *Cologne Cathedral, Germany. Detail of mosaics showing God creating the River Tigris, by Essenwein, 1885 – see page 17 (Photograph, Dombau Archiv, Cologne)*

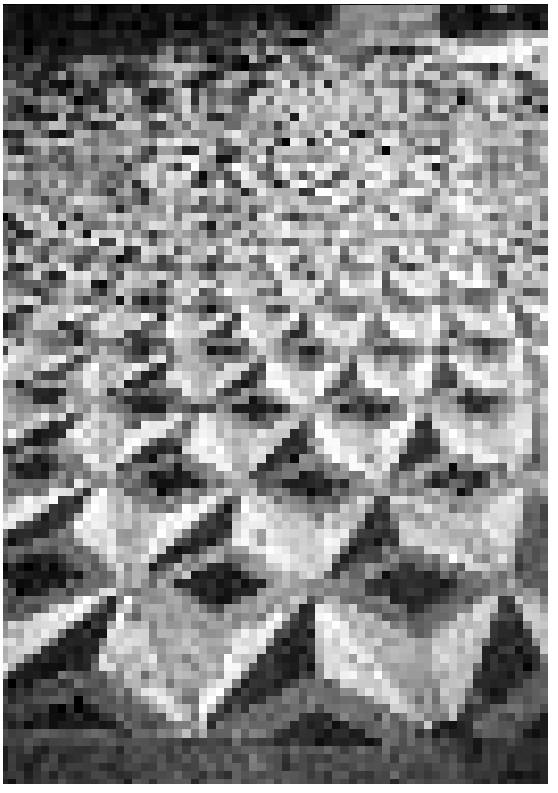


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Plate 16 *St John's Cathedral, Valetta, Malta. Ledger stones – see page 31 (Photograph, Mario Mintoff, Photocity, Valetta)*

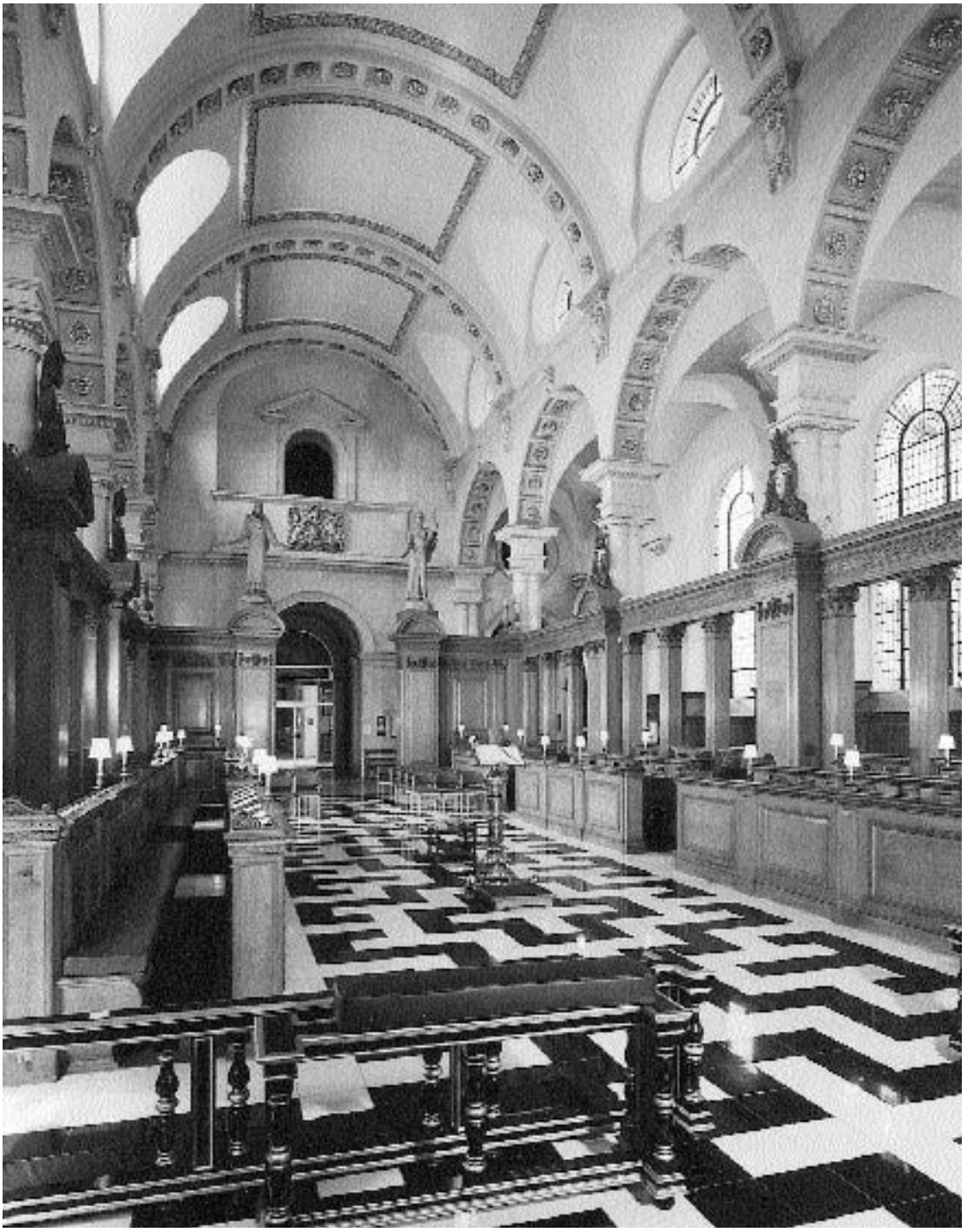

Plate 17 *St Bride's Church, Fleet Street, London, 1671–1678. Sir Christopher Wren. Restored after war damage in 1955–1957 by Godfrey Allen, Surveyor to the Fabric, St Paul's Cathedral – see page 19 (Photograph, National Monuments Record, RCHME)*

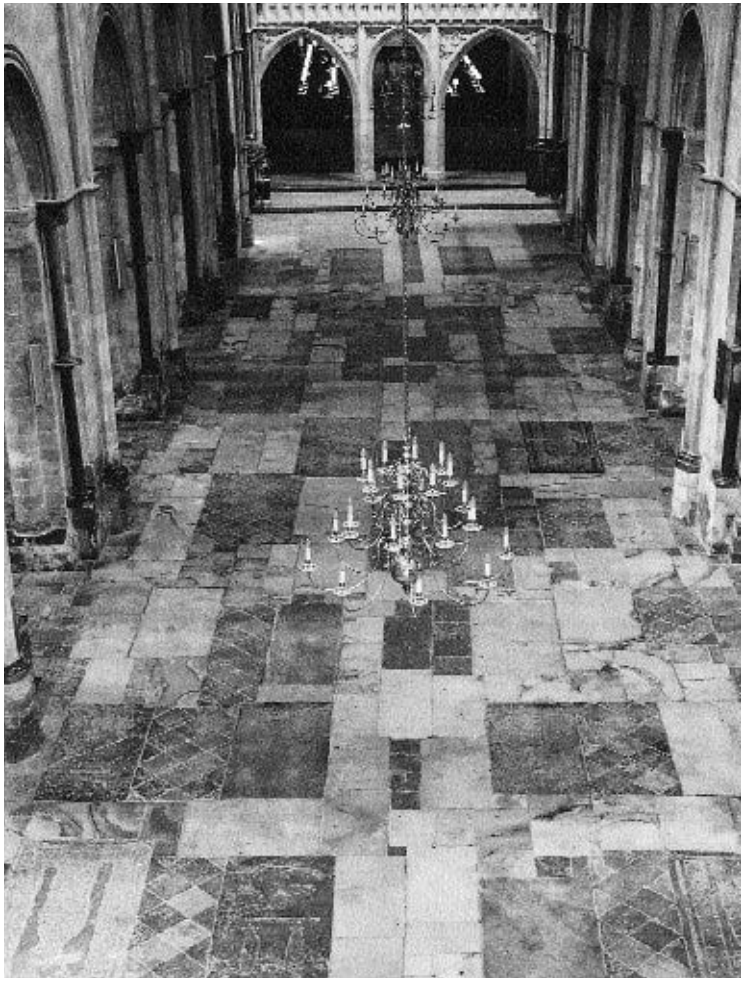

Plate 18 *Chichester Cathedral, West Sussex. Nave, twelfth-century paving showing medieval and later ledger stones and brass indents, inserted into surviving areas of medieval paving – see page 25 (Photograph, Michael Moore of Beaver Photography, Chichester. By kind permission of the Dean and Chapter, Chichester Cathedral)*

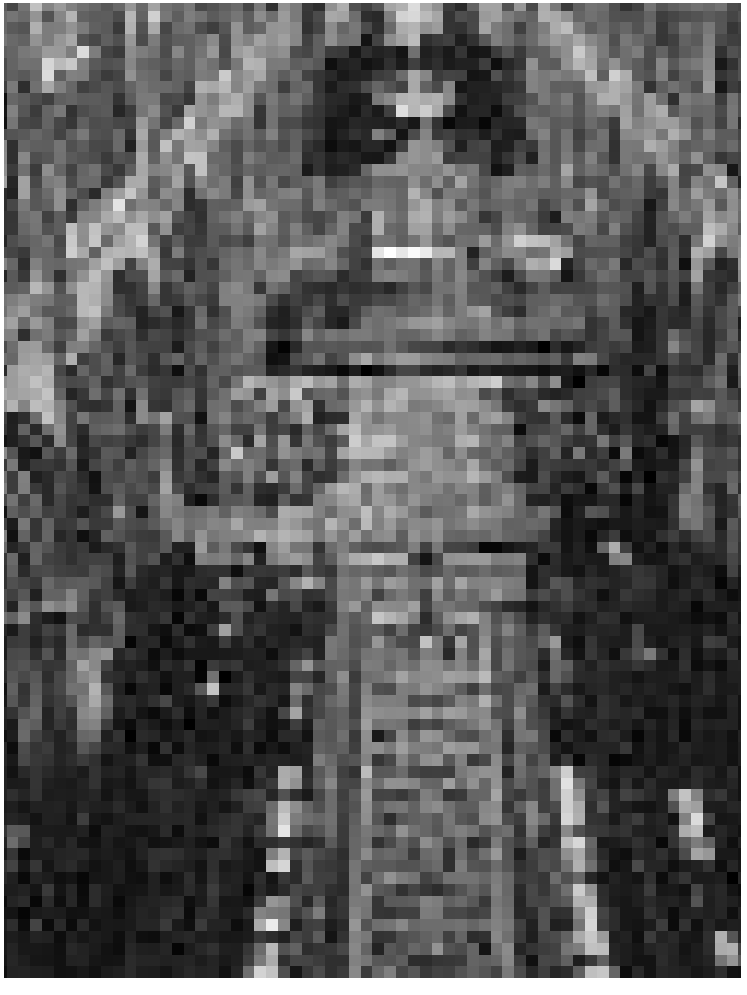

Plate 19 *Lichfield Cathedral. Scott's Minton tile floor in the choir and sanctuary, laid 1860. Many of the designs were replicated from fourteenth-century tile fragments found during excavations for the new heating system – see page 42 (Photograph, Warwick Rodwell)*

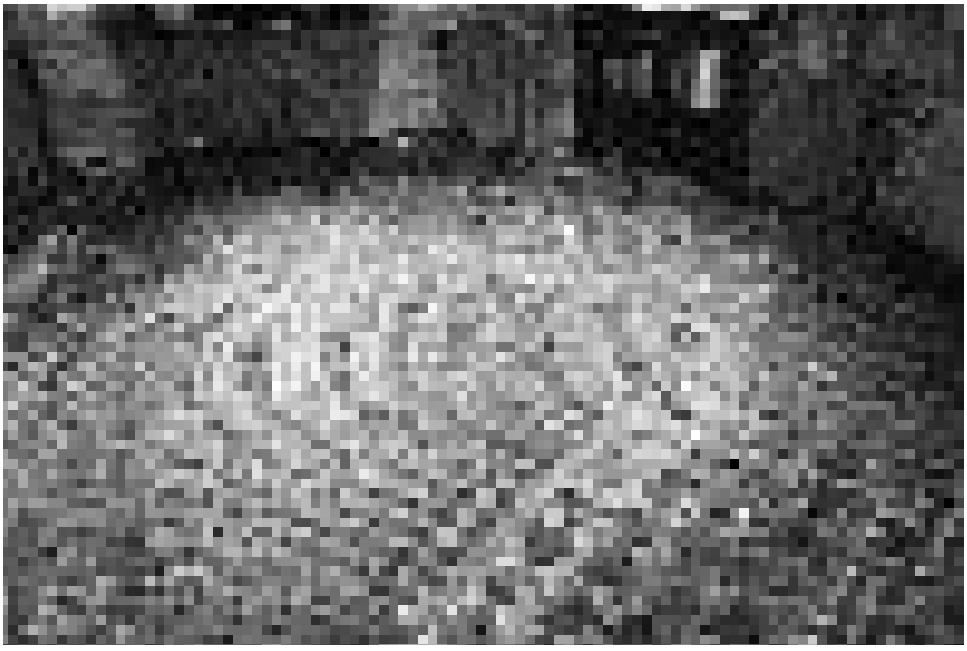

Plate 20 *Lichfield. Late thirteenth-century tile pavement in the octagonal library, which was recorded by rectified photography in 1988. The existence of this pavement was not fully recognized until the mid-1980s – see page 42 (Photograph, Warwick Rodwell)*

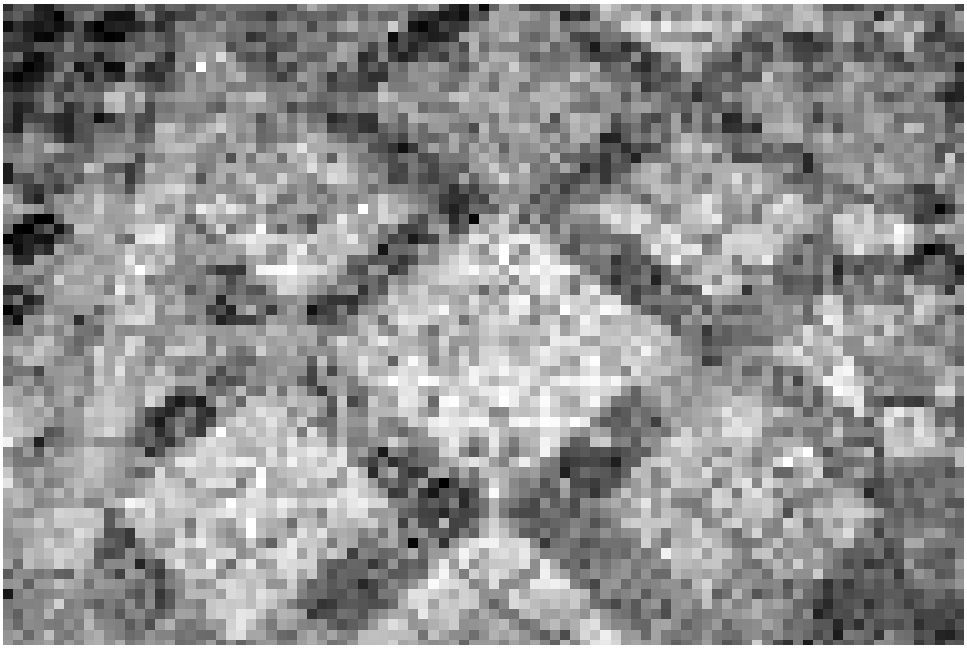

Plate 21 *Lichfield. Detail of the central carpet in the library, showing 9-tile and 16-tile settings within a lozenge framework – see page 42 (Photograph, Warwick Rodwell)*

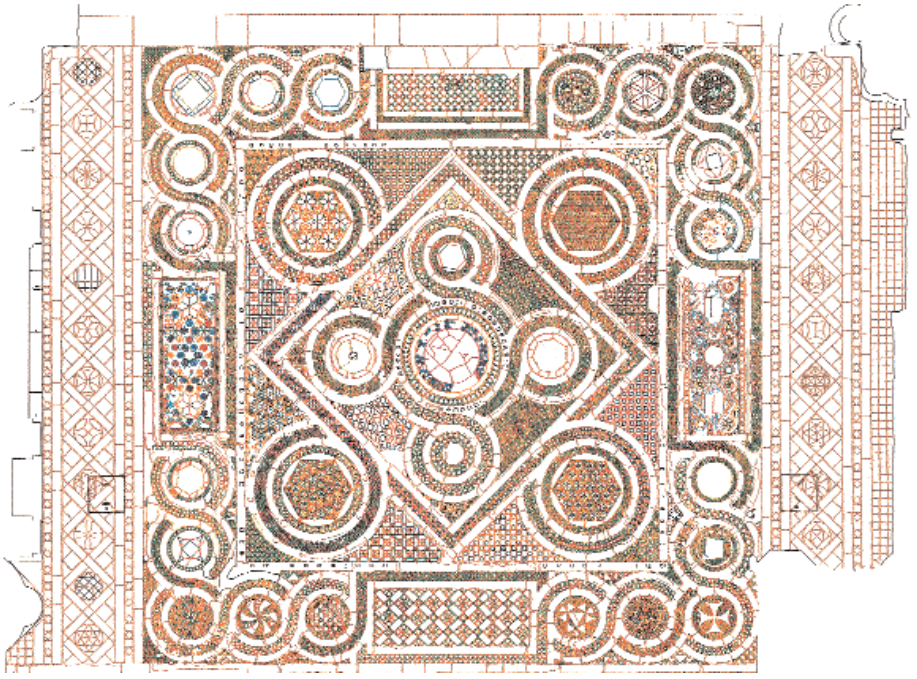

Plate 22a *Photogrammetric survey of the Cosmati Pavement, Westminster Abbey – see page 60 (Surveyed by The Downland Partnership, copyright Westminster Abbey)*

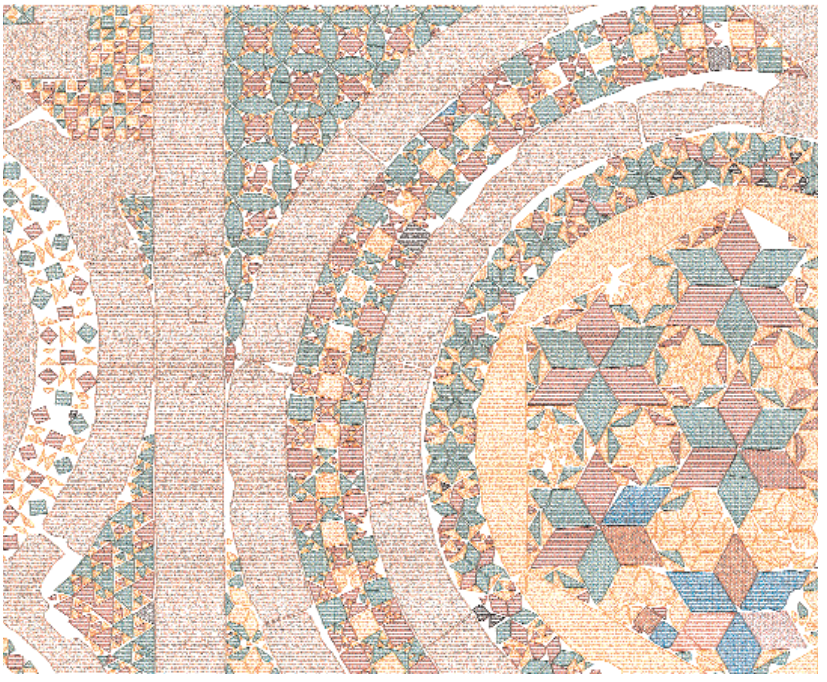

Plate 22b *Detailed section of photogrammetric survey of the Cosmati Pavement, Westminster Abbey – see page 60 (Surveyed by The Downland Partnership, copyright Westminster Abbey)*

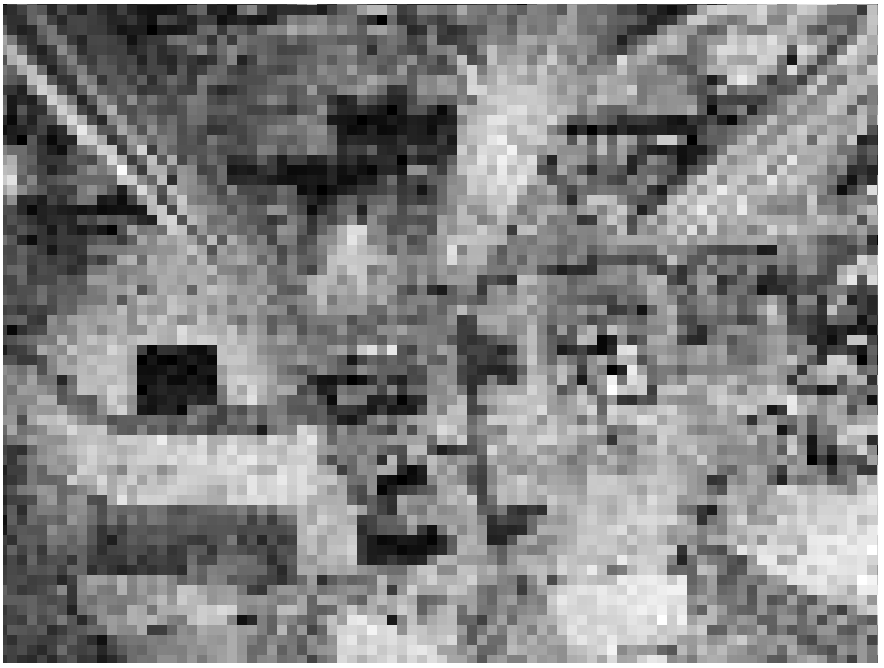

Plate 23 *Canterbury Cathedral. Vertical view of the excavations at the west end of the nave, showing Late Anglo-Saxon foundations, Norman floor-bedding mortar and 1377–1405 rebuild – see page 63 (Photograph, Canterbury Archaeological Trust)*

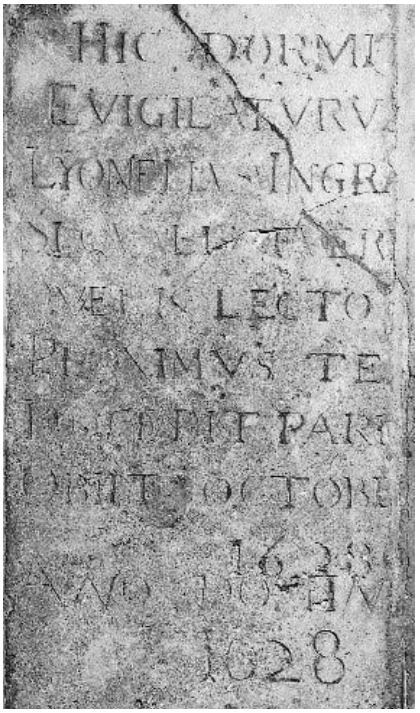

Plate 24 *Black-and-white photographic record of floor ledger stone in South Choir Aisle at York Minster – see page 81 (Photograph, RCHME)*

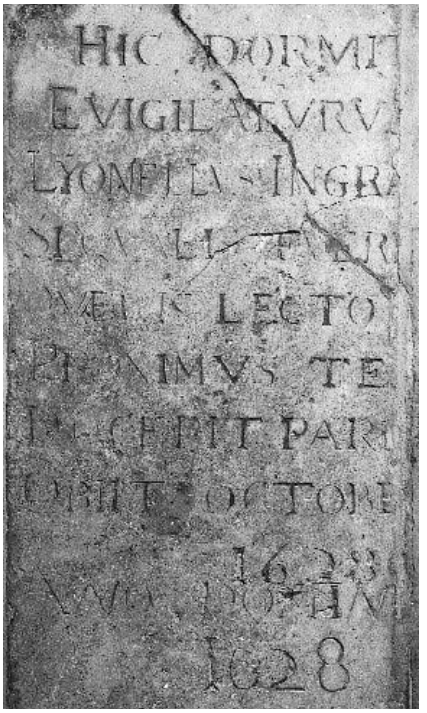

Plate 25 *Colour photographic record of floor ledger stone in South Choir Aisle at York Minster for comparison – see page 81 (Photograph, RCHME)*

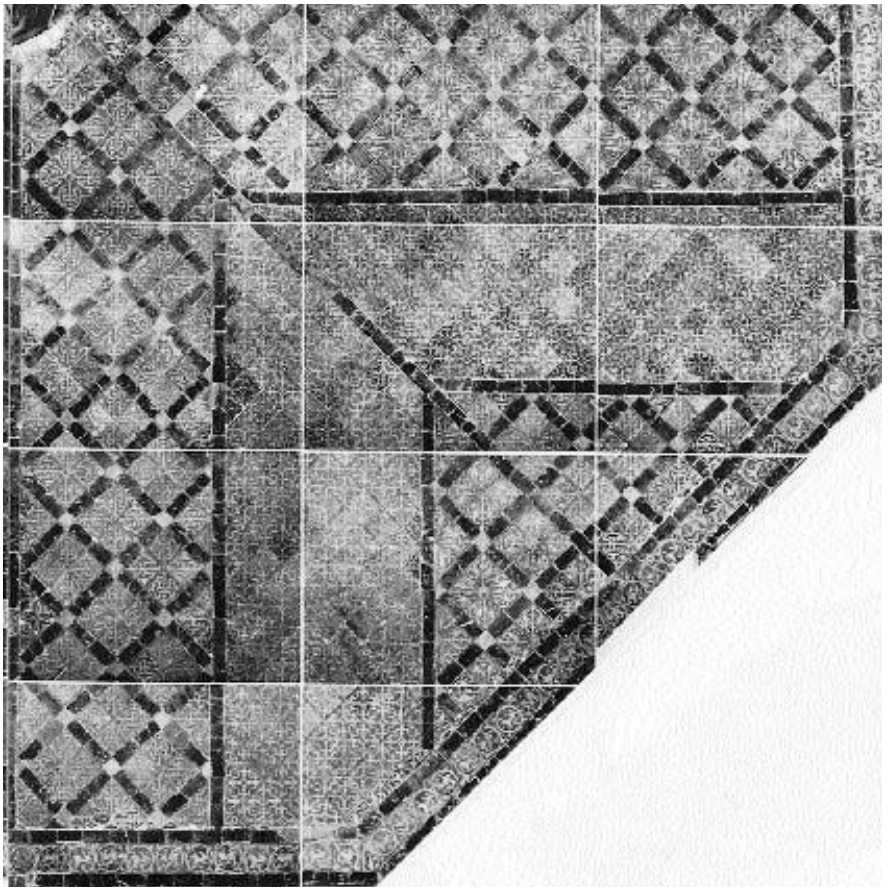

Plate 26 *Salisbury Cathedral (part). The Muniment Room. The joints between photographs can be seen, this method being necessitated due to the unevenness of the floor – see page 92 (Photograph, The Downland Partnership, copyright Salisbury Cathedral)*

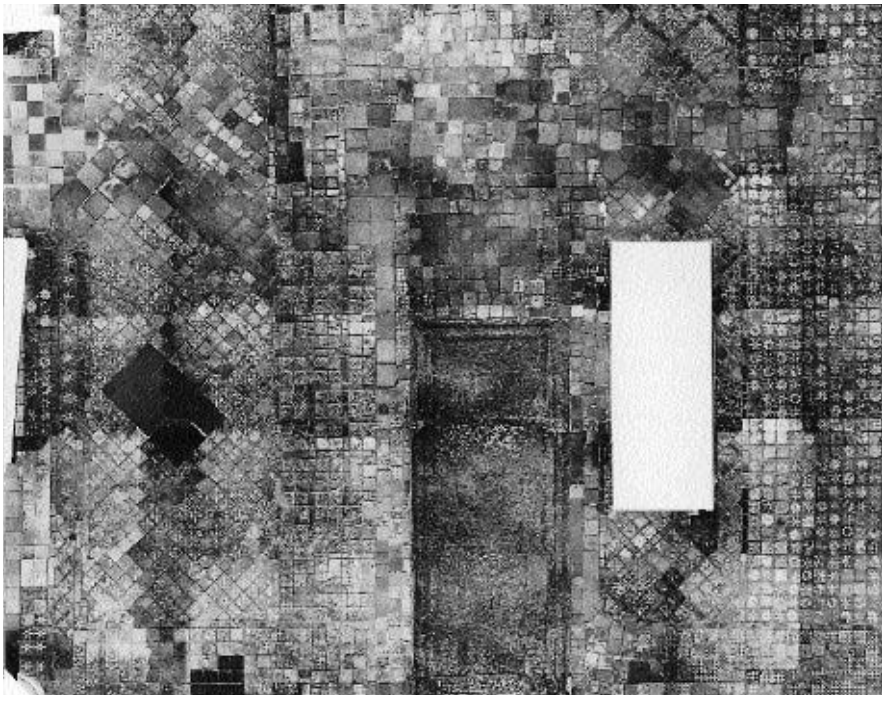

Plate 27 *Winchester Cathedral, Retrochoir. Part of the rectified photograph of the floor, prepared in consultation with Ross Dallas. The photograph is made up of mosaic sections taken over the whole floor area, which have been rectified and printed to scale. This enabled the production of record drawings of the whole floor area for use in planning, and in recording the work undertaken by the conservators – see page 91 and Chapter 12 (Photograph, Atkins AMC, copyright Winchester Cathedral)*

Plate 28 *Winchester Cathedral, ledger stones within the nave sanctuary, damaged by furniture, now removed – see page 120 (Photograph, Jane Fawcett)*

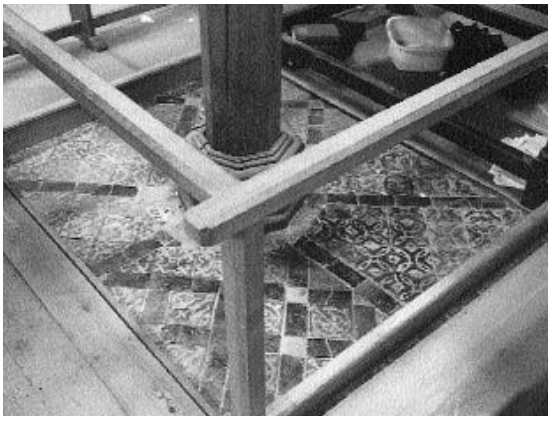

Plate 29 *Salisbury Cathedral. Muniment room, thirteenth-century tiled pavement, protected by timber floor – see page 123 (Photograph, Jane Fawcett)*

Plate 30 *St John's Co-Cathedral, Valetta, Malta. Marble ledger stones to Grand Masters of the Order of St John, damaged by stiletto heels, under repair – see page 128 (Photograph, Ross Dallas)*

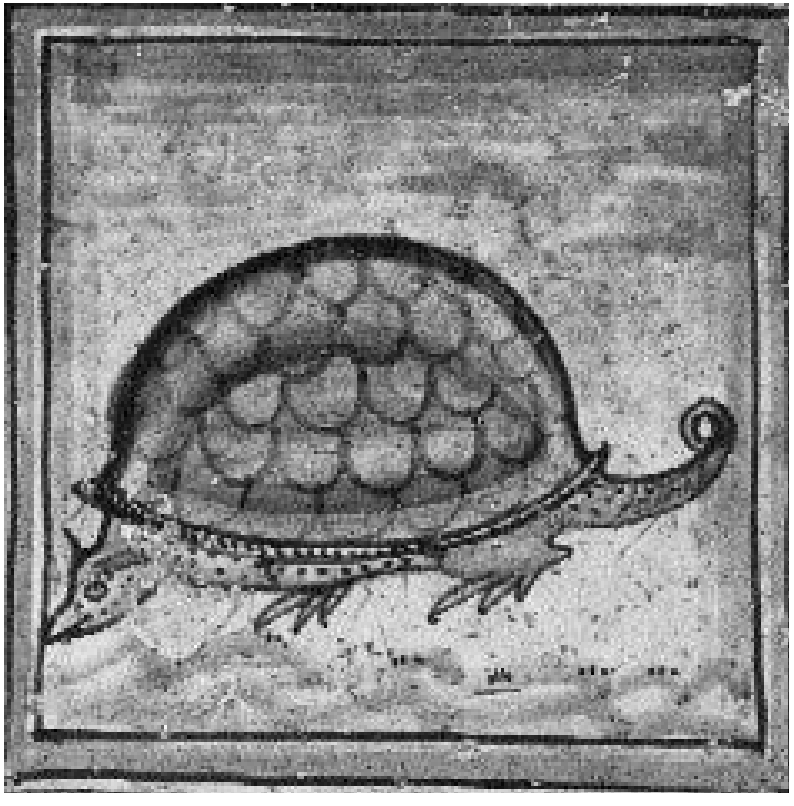

Plate 31 *The Chapel. The Vyne, Hampshire, c.1520. Flemish floor tile of c.1580 showing an armadillo. Bought by Lord Sandys in Boulogne – see page 130 (Photograph, Derrick E. Witty, The National Trust)*

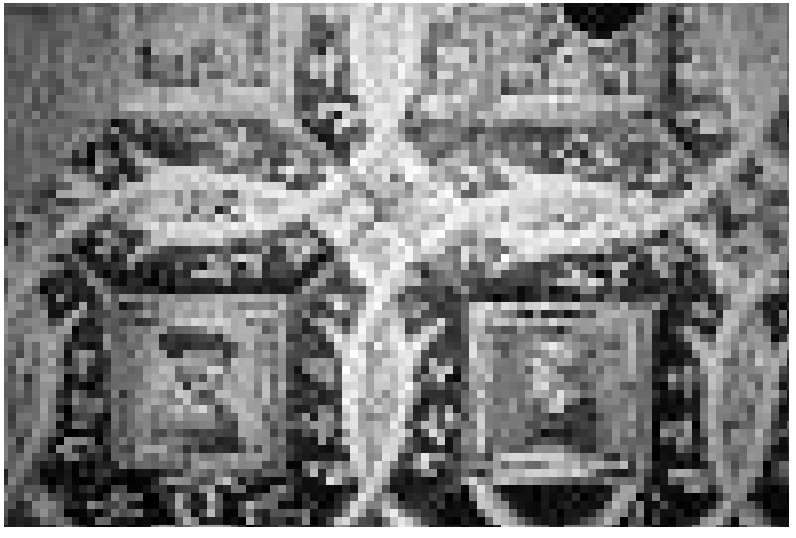

Plate 32 *Château de Chenonceaux, France. Detail, Flemish floor tiles, c.1513. Laid by Catherine de Briconnet and Thomas Bohier, owners – see page 131 (Photograph, Jane Fawcett)*

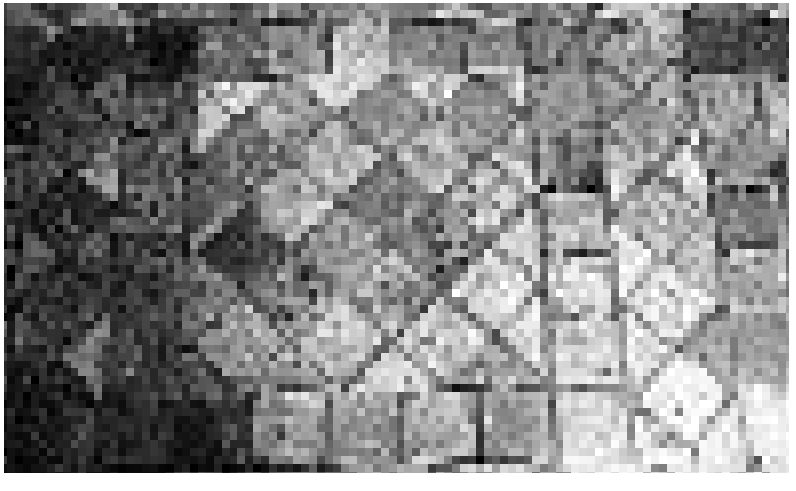

Plate 33 *Château de Chenonceaux, France. Earthenware tiles, sixteenth century – see page 131 (Photograph, Jane Fawcett)* ▶

Plate 34 *Scarisbrick Hall, Lancashire, 1842. A.W. Pugin. Great Hall, encaustic tile floor – see page 132 (Photograph, Jane Fawcett)*

Plate 35 *Osborne, Isle of Wight. Encaustic tiles by Minton, detail – see page 132 (Photograph, English Heritage)*

Plate 36 *Osborne, Isle of Wight, 1845–1846. Thomas Cubitt. Grand corridor – see page 132 (Photograph, Crown Copyright)*

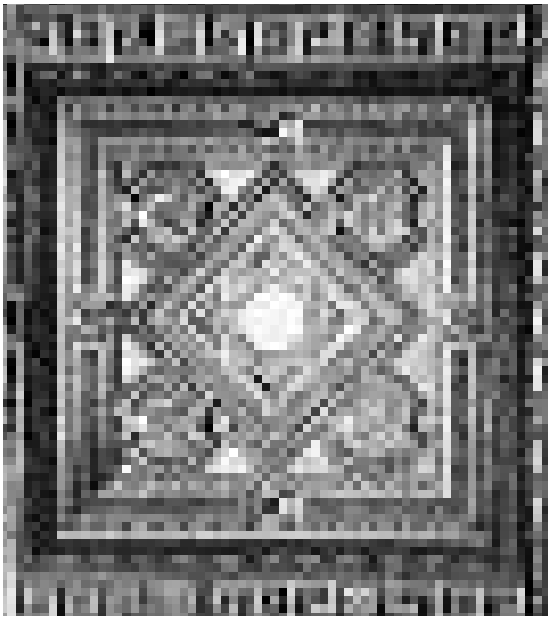

Plate 37 *The Royal Exchange, London, 1841–1844. Sir William Tite. Encaustic pavement, based on Cosmati designs by Henry Pether – see page 135 (Photograph, Jeff Kelly)*

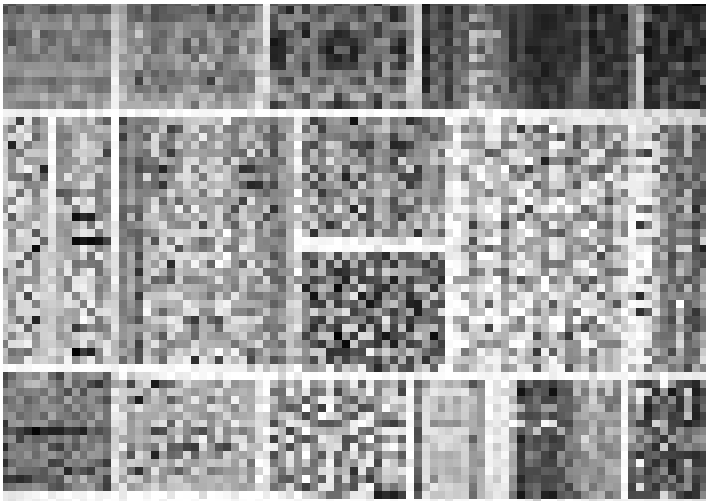

Plate 38 *Owen Jones, The Grammar of Ornament, 1868, adapted for tile designs. Persian, No. 2 – see page 132 (Photograph, Jane Fawcett)*

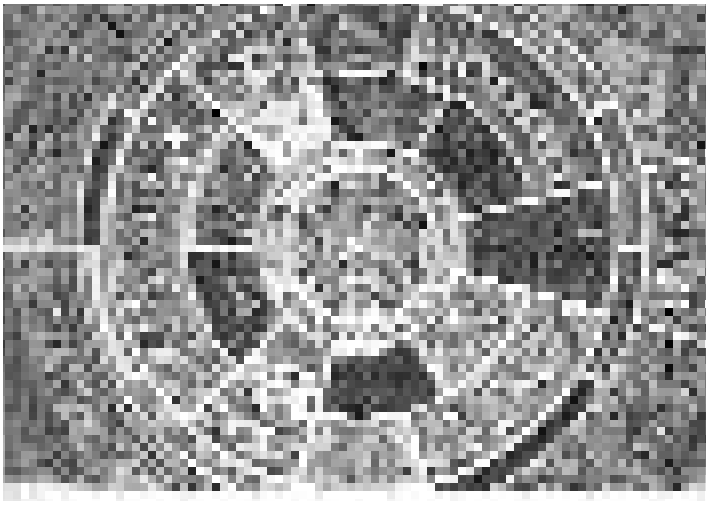

Plate 39 *Owen Jones, The Grammar of Ornament, 1868, adapted for tile designs. Renaissance, No. 5 – see page 132 (Photograph, Jane Fawcett)*

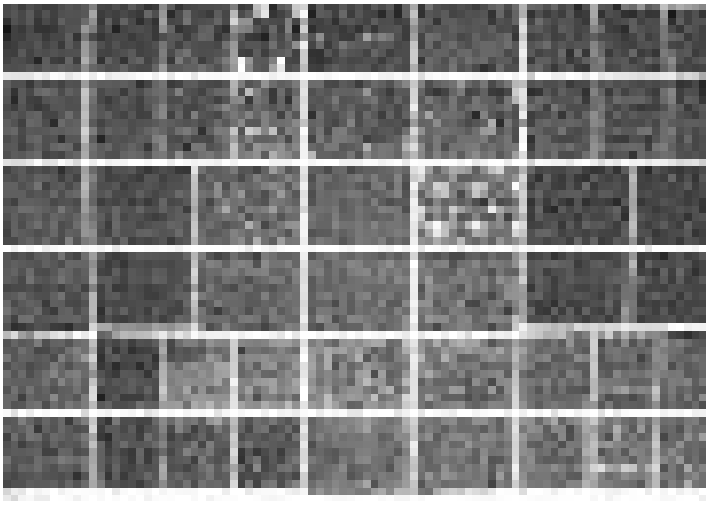

Plate 40 *Owen Jones, The Grammar of Ornament, 1868, adapted for tile designs. Middle Ages, No. 3 – see page 132 (Photograph, Jane Fawcett)*

Plate 41 *The Foreign Office, London, 1861. Sir George Gilbert Scott. Grand Staircase in 1996, after restoration by Cecil Denny Highton. Integrated decorative scheme. Murals by Clayton and Bell, floor tiles by Minton – see page 133 (Photograph, Adam Woolfit)*

Plate 42 *Pella, near Thessalonika, Greece. Palace of Philip of Macedon, c.400 BC. Floor mosaics, stag hunt – see page 135*

Plate 43 *Roman Villa, Chedworth, second century AD. The dining room. Mosaic of Spring, with a bird in one hand and a basket of fruit in the other – see page 138 (Photograph, National Trust Photographic Library, Ian Shaw)*

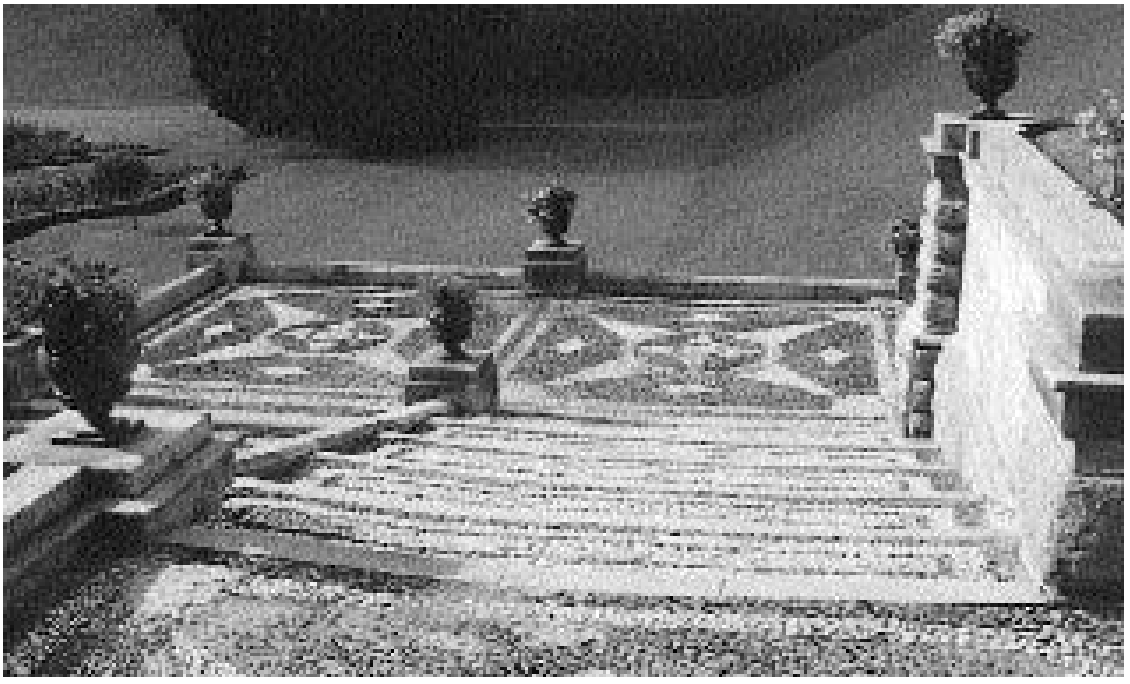

Plate 44 *Powerscourt, Co. Wicklow, Ireland. Nineteenth-century pebble mosaic, garden terrace steps – see page 138 (Photograph, Jane Fawcett)*

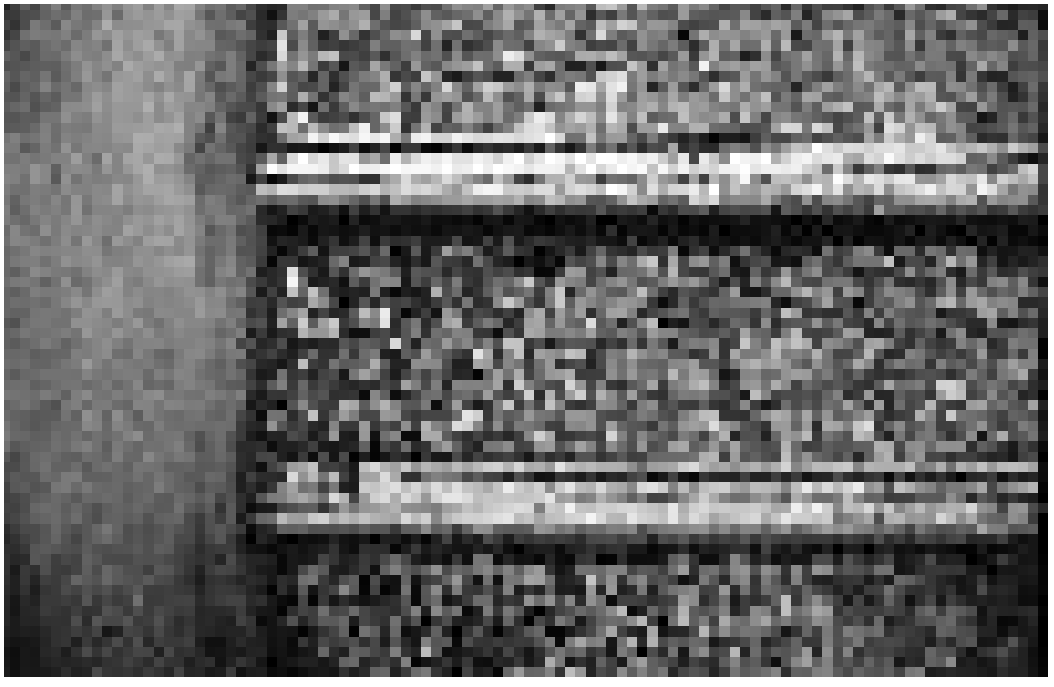

Plate 45 *Villa Medici, Rome, c.1588. Pebble mosaic on orangery stairs – see page 138 (Photograph, Jane Fawcett)*

Plate 46 *Queen's House, Greenwich, London, 1635. Inigo Jones. Entrance hall. One of the first examples in England of a circular composition, already famous in Italy in the sixteenth century – see page 144 (Photograph, National Maritime Museum, Greenwich)*

Plate 47 *Petworth House, West Sussex, 1688. Daniel Marot. The marble hall. Laid in 1692 by James Sayers, mason – see page 145 (Photograph, National Trust Photographic Library, Andreas von Einsiedel)*

Plate 48 *Osterley Park, Middlesex, 1767. Robert Adam. Entrance hall. The stone floor reflects the ceiling design – see page 147 (Photograph, National Trust Photographic Library, Oliver Brown)*

Plate 49 *Kedleston Hall, Derbyshire, c.1760. Robert Adam. The marble hall, constructed from Derbyshire alabaster. An integrated architectural interior dominated by giant Corinthian columns – see page 147 (Photograph, National Trust Photographic Library, Andrew Haslam)*

Plate 50 *Neues Schloss Schleissheim, near Munich, Germany. Begun in 1701 by Zucalli and decorated in 1715 by Effner, for Max Emmanuel, Elector of Bavaria. The Lower Galley – see page 149 (Photograph, Jane Fawcett)*

Plate 51 *Sans Souci Palace, Potsdam, 1745–1747. Joseph Boumann. Circular hall. Rococo marble floor – see page 149 (Photograph, David Carnwath, Architectural Association)*

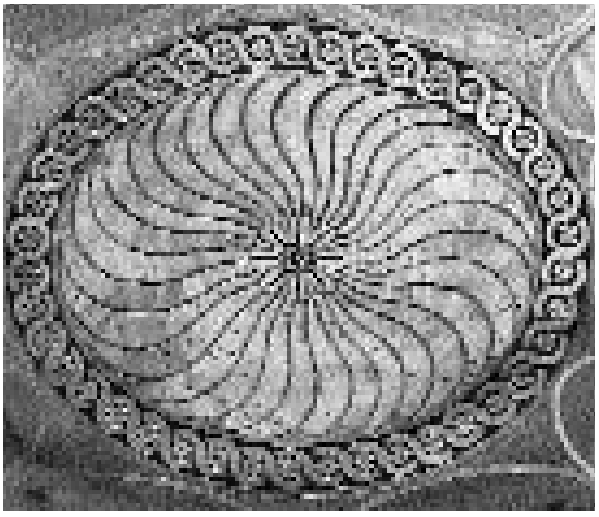

Plate 52 *Mount Stewart House, Co. Down, Northern Ireland, by George Dance. The Music Room. Detail of marquetry floor – see page 153 (Photograph, National Trust Photographic Library, Peter Aprahamian)*

Plate 53 *Schloss Weissenstein, Pommersfelden, near Bamburg, Germany, 1714–1749. Ferdinand Plitzner. Spiegel Kabinett. Marquetry floor – see page 154 (Photograph, Bayerisches Landesamt für Denkmalpflege, Seitz und Zöbeley GMBH, Munich)*

Plate 54 *Schloss Ellingen, near Nuremberg, Germany. Eighteenth-century marquetry floor – see page 155 (Photograph, Axel Griesinger)*

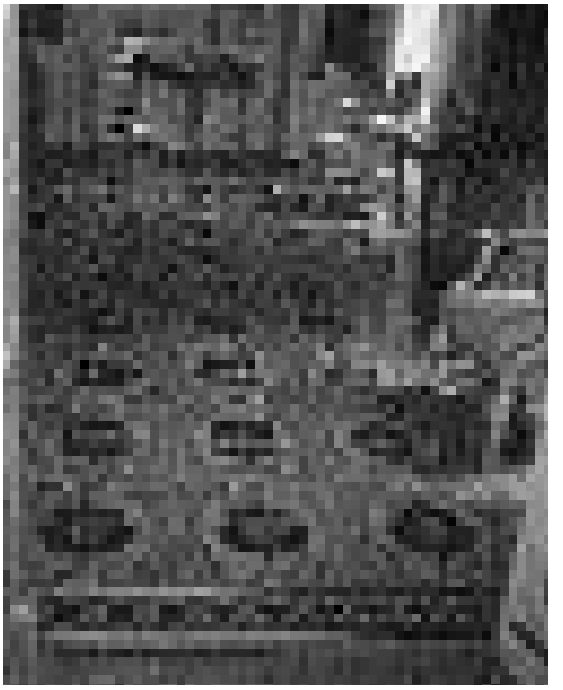

Plate 55 *Lazienki Palace, Warsaw, Poland. Standing on an artificial island, surrounded by a lake, the Palace was built, in the seventeenth century, as a Bath House. The former bathroom is lined with seventeenth-century Dutch tiles with a chequered marble floor. The palace was extended by King Stanislaus Poniatowski in 1772. The superb marquetry floors were skilfully restored after total destruction during the war, in the 1950s and 1960s – see page 155 (Photograph, Jane Fawcett)*

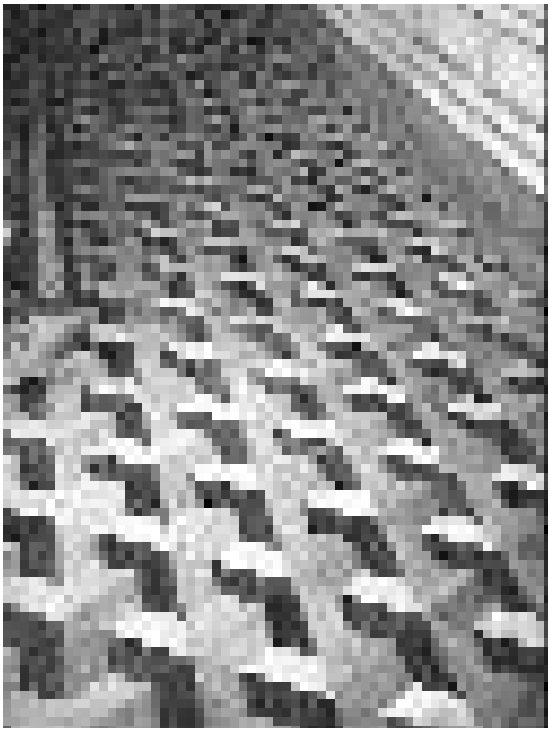

Plate 56 *Wilanow Palace, Warsaw, Poland, 1679–1731. A Baroque palace, built for King Jobieski, with spectacular interiors, partially destroyed during the Nazi occupation, restored from 1955–65. Marquetry floor, ante-room, restored after war damage – see page 155 (Photograph, Jane Fawcett)*

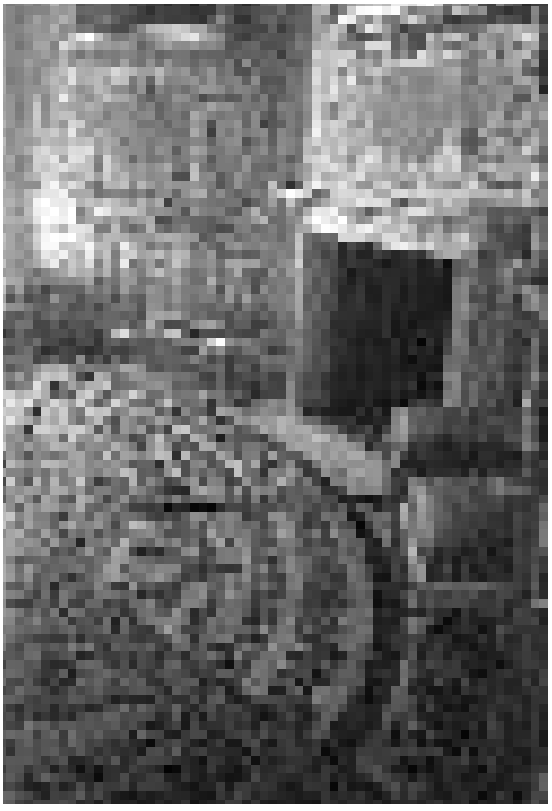

Plate 57 *Royal Castle, Warsaw, 1569–1619. Razed to the ground by the Nazis, and lovingly reconstructed from 1971 to 1984, it contains interiors of outstanding splendour, and many of the original contents. The European Monarch's Portrait Room (used by the King for confidential meetings on matters of state). Marquetry floor – see page 155 (Photograph, Jane Fawcett)*

Plates 58 and 59 *Tsarskoe Selo, near St Petersburg, Russia. The eighteenth-century Summer Palace of Empress Elizabeth and, from 1762, of Catherine the Great. The magnificent interiors, destroyed during the Nazi occupation, have been lovingly restored. The fine marquetry floors, containing oak, Kalerian birch, ebony, lime, mahogany and pine, also restored, are protected by the compulsory use of slippers – see page 155 (Photographs, Jane Fawcett)*

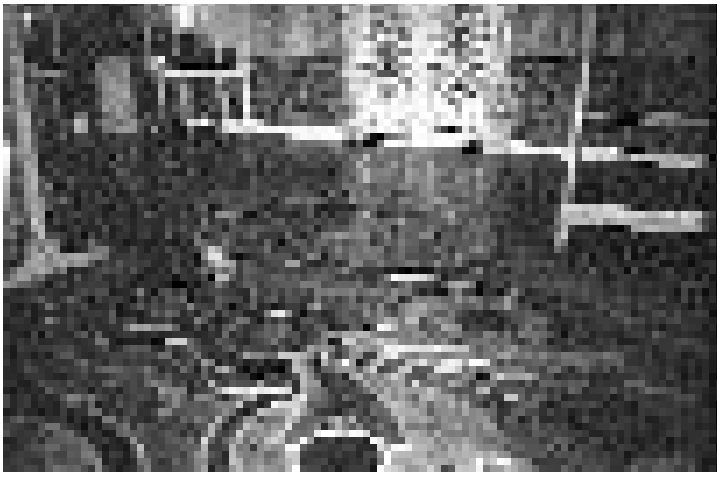

Plate 60 *Saltram, Devon. The saloon. Carpet design by Robert Adam, 1768–1772 – see page 159 (Photograph, National Trust Photographic Library, Andreas von Einsiedel)*

Plate 61 *Culzean Castle, Ayrshire, Scotland, 1779–1792. Saloon carpet, designed by Robert Adam – see page 159 (Photograph, National Trust for Scotland)*

Plate 62 *Belton House, Lincolnshire. William Winde 1685–1688 and James Wyatt 1770s. Tyrconnel Room, painted floor, showing the Belton greyhounds, and Brownlow Arms, possibly late seventeenth century – see page 162 (Photograph, National Trust Photographic Library, Mark Fiennes)*

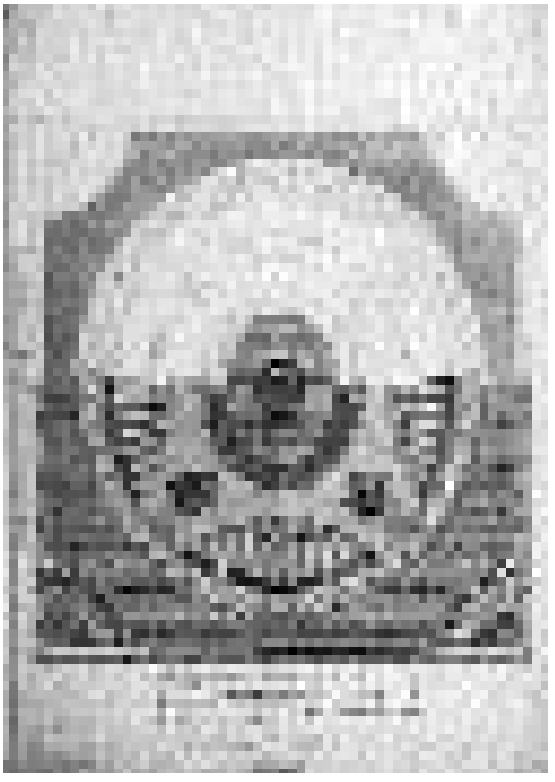

Plate 63 *Belton House, Lincolnshire. Design for a carpet by James Wyatt, 1770s – see page 160 (Photograph, Temple Newsam)*

Plate 64 *The Great Hall, Ham House, showing the dais, with its marquetry floor of c.1672–1682, after its recent restoration, and the early seventeenth-century chequered marble floor – see page 173 (Photograph, The National Trust)*

Plate 65 *The Queen's Bedchamber, Ham House, 1673, as remodelled by the 4th Earl of Dysart in c.1744 – see page 174 (Photograph, courtesy of the Trustees of the Victoria & Albert Museum)*

Plate 66 *Ham House. The marquetry of the Queen's Closet floor, looking towards the dais – see page 175 (Photograph, courtesy of the Trustees of the Victoria & Albert Museum)*

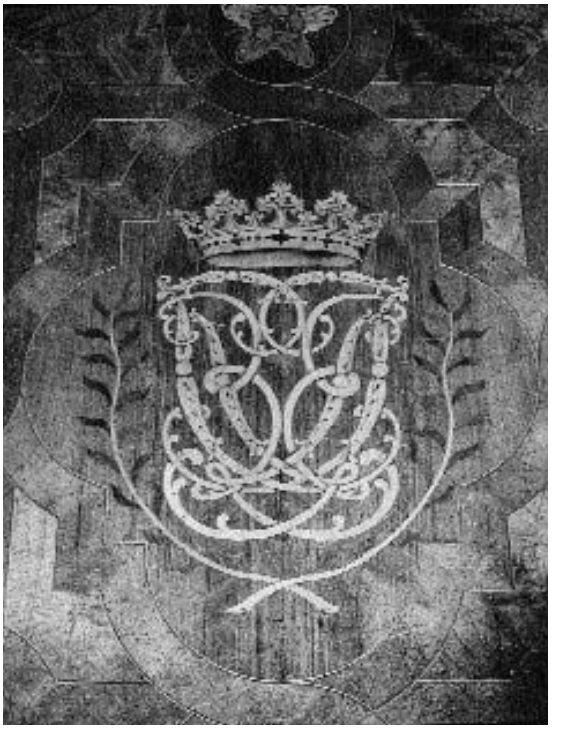

Plate 67 *Ham House. The Queen's Closet: Harlow's marquetry floor, 1673 (detail) showing the damage wrought by stiletto heels, presumably in the early years of public visiting after the gift of the house to the National Trust in 1947 – see page 175 (Photograph, courtesy of the Trustees of the Victoria & Albert Museum)*

Plate 68 *Uppark. The Red Drawing Room, repaired and conserved – see page 183 (Photograph, The Conservation Practice)*

Plate 69 *Central Lobby, Palace of Westminster. Tiles by Minton – see page 187 (Photograph, George Garbutt)*

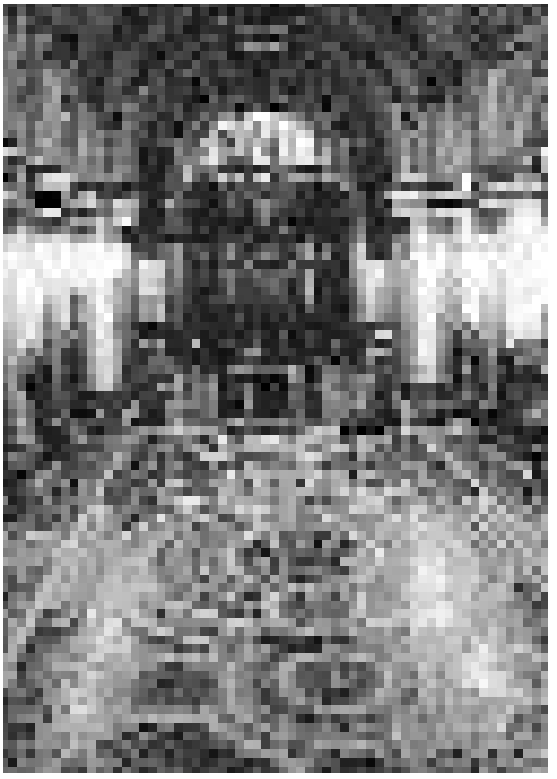

Plate 70 *St George's Hall, Liverpool. General view of the Great Hall – see page 194 (Photograph, Donald Insall)*

Plate 71 *St George's Hall, Liverpool. The Great Hall. Detail of tile border – see page 195 (Photograph, Donald Insall)*

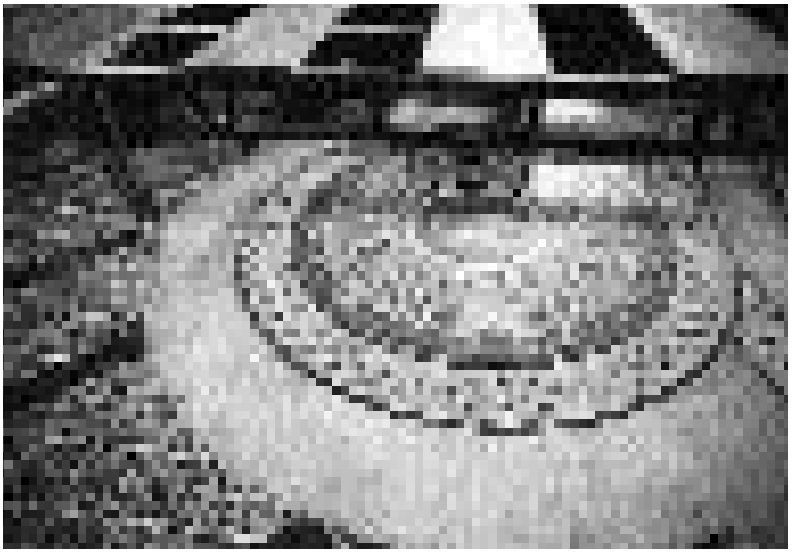

Plate 72 *St George's Hall, Liverpool. View of Great Hall tiles, partly exposed, partly covered by protective wooden floor – see page 195 (Photograph, Donald Insall)*

Plate 73 *At Dyrham Park, near Bath, this main staircase cannot bear the weight of the constant flow of visitors. The treads and the landing also show damage from sharp heels. Now closed to the public – see page 198 (Photograph, National Trust)*

Plate 74 *Claydon House, Buckinghamshire, c.1760. Thomas Robinson, Staircase hall, showing marquetry on treads and risers, inlaid decoration on the soffits, and marble chequered floor in the hall. Staircase recently repaired and strengthened, now closed to the public – see page 153 (Photograph, Vera Collingwood)*