Historic England

Buckinghamshire

Building Stones of England

The Building Stones of England

England's rich architectural heritage owes much to the great variety of stones used in buildings and other structures. The building stones commonly reflect the local geology, imparting local distinctiveness to historic towns, villages and rural landscapes.

Historic England and the British Geological Survey (BGS), working with local geologists and historic buildings experts, have compiled the Building Stones Database for England to identify important building stones, where they came from and potential alternative sources for repairs and new construction.

Drawing on this research, plus BGS publications and fieldwork, guides like this one have been produced for each English county. The guides are aimed at mineral planners, building conservation advisers, architects and surveyors, and those assessing townscapes and countryside character. The guides will also be of interest if you want to find out more about local buildings, natural history, and landscapes.

This guide was prepared by Andy King (Geckoella Ltd), Phil Collins (Phil Collins Associates) and Graham Lott (formerly British Geological Survey) for Historic England.

First published by Historic England in August 2018. This edition published by Historic England May 2023.

Please refer to this guide as:

Historic England 2023 *Buckinghamshire. Building Stones of England*. Swindon. Historic England.

HistoricEngland.org.uk/advice/technical-advice/

Front cover: Cottages, Hambledon. Flint. © Michael Winters / Alamy Stock Photo.

How to Use this Guide

Each guide describes the local building stones in their geological timescale order, starting with the oldest layers through to the youngest. The guide ends with examples of other notable building stones from other parts of England and further afield.

Geological time periods, groups, formations and building stones

Each building stone is listed under the relevant geological timescale, group and formation. A formation may be divided into members and where relevant these are referenced in individual building stone sections.

Middle Jurassic
↑— geological time period

Inferior Oolite Group, Lincolnshire Limestone Formation
↑— geological group ↑— geological formation

Lincolnshire Limestone
↑— building stone (alternative or local name)

Bedrock geology map and stratigraphic table

To help you with the geology of the area, there is a bedrock geology map and a stratigraphic table which shows the layers of rocks and the associated building stones in this geological timescale, group, formation order.

Page numbers for each building stone are included in the stratigraphic table for ease of reference. The page numbers are inverted to correspond with the geological age order.

Contents list

If you click on the page number for a building stone in the Contents list, you will go straight to the relevant section in the guide.

Building stone sources and building examples

A companion spreadsheet to this guide provides:

- More examples of buildings. Information is included on building type, date, architectural style, building stone source, and listed/ scheduled status
- A list of known (active and ceased) building stone sources such as quarries, mines, pits and delphs
- Additional information on building stones including lithology, grain size, sedimentary structures, key identification features, and notes on failure/weathering, and use.

The Building Stone GIS map allows you to search the Building Stones Database for England for:

- A building stone type in an area
- Details on individual mapped buildings or stone sources
- Potential sources of building stone sources within a given proximity of a stone building or area
- Buildings or stone sources in individual mineral planning authority area.

Further Reading, Online Resources and Contacts

The guide includes geological and building stone references for the area. A separate guide is provided on general Further Reading, Online Resources and Contacts.

Glossary

The guides include many geological terms. A separate Glossary explaining these terms is provided to be used alongside the guides.

The guides use the BGS lexicon of named rock units.

Mineral and local planning authorities

This guide covers the mineral planning and unitary authority areas of Buckinghamshire Council and Milton Keynes Council.

Contents

1 Introduction

Despite its comparatively small size, Buckinghamshire has a varied topographic character. This is a direct reflection of its underlying geology, which principally ranges from Jurassic to Cretaceous in age. The diverse geology comprises interbedded mudstones, limestones, chalks and sandstones, many of which have been exploited to provide building materials. Stone was once quarried on a relatively small scale at many locations. Natural stone features prominently in many of the county's surviving historic buildings and also in other stone structures, including canal walls, road and railway bridges, and field and other boundary walls. Over large areas of the county, the bedrock succession is concealed by largely unconsolidated Quaternary and recent sediments.

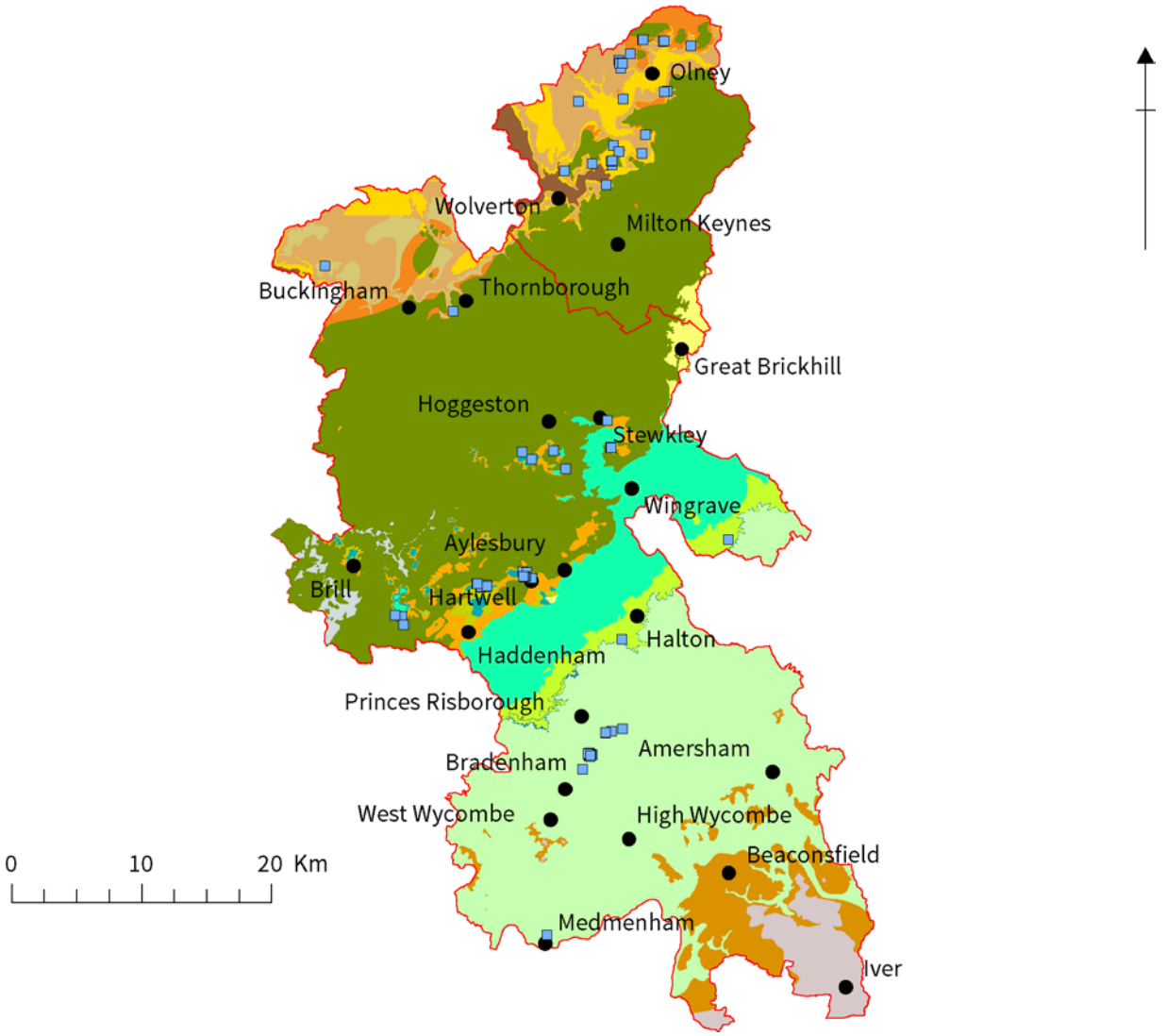
Historically, Buckinghamshire has drawn extensively on the building stone resources of neighbouring counties, which were readily transported and imported via the rivers and former Roman roads. By the late 19th and early 20th centuries, a significant proportion of the natural stone used in the developing infrastructures of Buckinghamshire's larger population centres was imported from sources much further afield, both in the UK and overseas.

Figure 1: Upper Church Street, Cuddington. Portland and Purbeck limestones (Buckinghamshire types).

Figure 2: Dashwood Mausoleum, West Wycombe. Quarry Flint and Quaternary Flint.

Figure 3: Old Vicarage, Mentmore. Brickhill Ironstone.

Bedrock Geology Map



Key

Building stone sources

Bedrock geology

London Clay Formation — clay, silt and sand

Lambeth Group — clay, silt and sand

White Chalk Subgroup — chalk

Melbourn Rock Member — chalk and limestone

Grey Chalk Subgroup — chalk

Totternhoe Stone Member — chalk and calcarenite

Selbourne Group (Undifferentiated) — mudstone, siltstone and sandstone

Lower Greensand Group (Undifferentiated) — sandstone and mudstone

Wealden Group (Undifferentiated) — mudstone, siltstone and sandstone

Purbeck Group (Undifferentiated) — limestone and mudstone

Portland Group (Undifferentiated) — limestone and calcareous sandstone

Ancholme Group (Undifferentiated) — mudstone, siltstone and sandstone

Corallian Group (Undifferentiated) — limestone, sandstone and mudstone

Great Oolite Group — limestone and argillaceous rocks

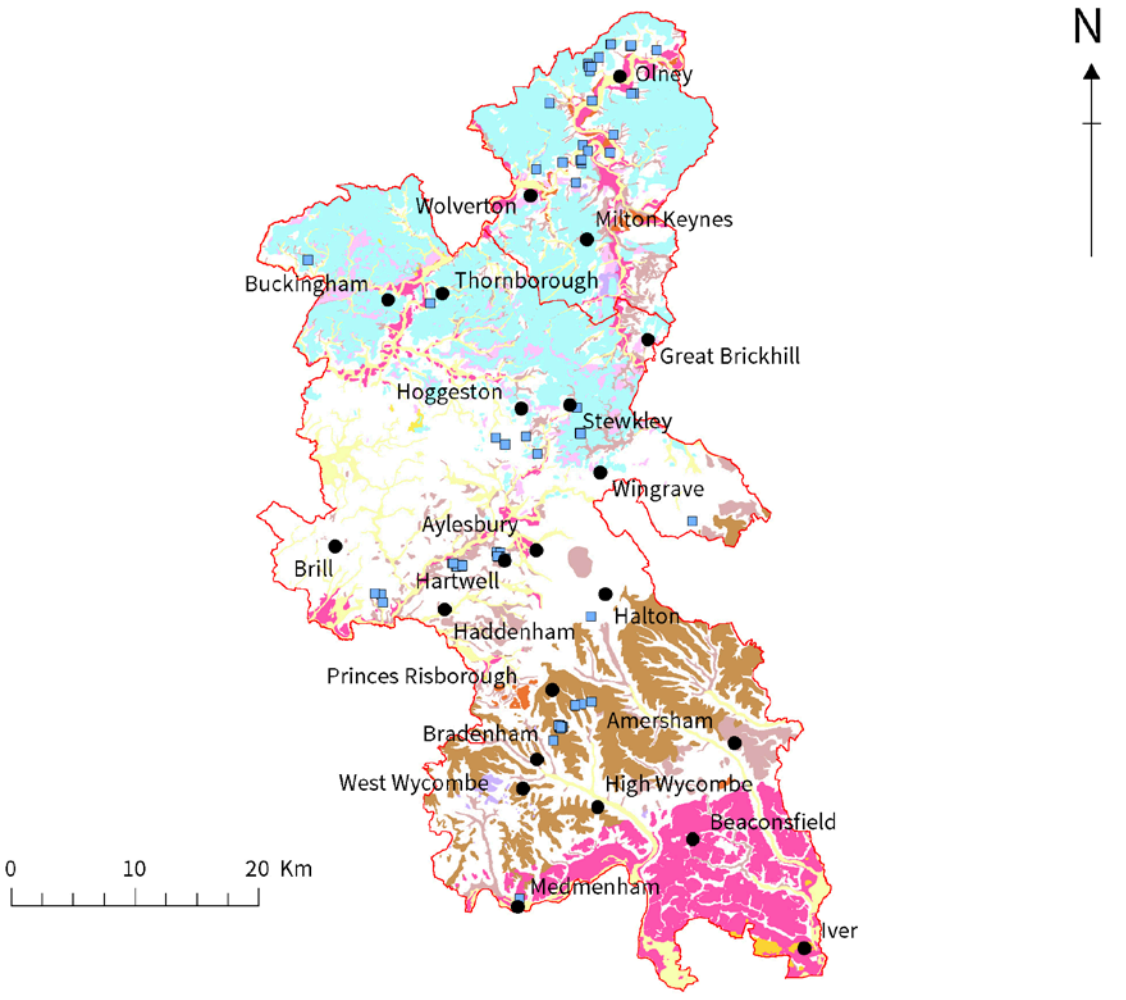
Cornbrash Formation — limestone

Forest Marble Formation — limestone and mudstone, interbedded

Blisworth Limestone Formation and White Limestone Group (Undifferentiated) — limestone

Lias Group — mudstone, siltstone and ferruginous limestone

Superficial Geology Map



Key

Building stone sources

Superficial geology

Alluvium — clay, silt, sands and gravel

Brickearth — peat, clays, silt and sand

Head — sands, gravels, silt, and clay

River Terraces — sands, gravels and clay

Glaciofluvial and Glaciolacustrine Deposits — sands, gravels, silt and clay

Glacial Tills — clays, sands, gravels, boulders

Tufa

Clay-with-flints — sands, gravels, clay and silt

Stratigraphic Table

Geological timescale	Group		Formation	Building stone	Page
Quaternary	various		various	Glacial pebbles and cobbles Quaternary Flint (Field Flint, Brown Field Flint, Clay-with-flints) Sarsen Stone (Greywether, Denner Hill Stone, Quartzose Sandstone, Silcrete) False Puddingstone (Ironstone conglomerate, including Iver Puddingstone and Wingrave Puddingstone types)	46 43 41 39
Tertiary	Thames Group		London Clay Formation		
	Lambeth Group		Reading Formation	Bradenham Puddingstone (Puddingstone, Conglomerate)	38
			Upnor Formation		
	Montrose Group		Thanet Formation		
Upper Cretaceous	Chalk Group	White Chalk Subgroup	Newhaven Chalk Formation	Chalk (Chalk Block, Clunch, Rag) Quarry Flint (Fresh Flint)	36 34
			Seaford Chalk Formation		
			Lewes Nodular Chalk Formation		
			New Pit Chalk Formation		
			Holywell Nodular Chalk Formation (including Melbourn Rock Member)		
		Grey Chalk Subgroup	Zig Zag Chalk Formation	Totternhoe Stone	33
			West Melbury Marly Chalk Formation		
Lower Cretaceous	Selborne Group		Upper Greensand Formation		
			Gault Formation		
	Lower Greensand Group		Woburn Sands Formation	Brickhill Ironstone (Carstone)	31
	Wealden Group		Whitchurch Sand Formation	Whitchurch Sandstone, Bowel Stone	29
Upper Jurassic	Purbeck Group		Purbeck Formation	Purbeck Limestone (Buckinghamshire type)	28
	Portland Group		Portland Formation	Portland Limestone (Buckinghamshire type)	26
	Ancholme Group		Kimmeridge Clay Formation		
			Ampthill Clay Formation		
			West Walton Formation		
			Oxford Clay Formation		
Middle Jurassic			Kellaways Formation		
	Great Oolite Group		Cornbrash Formation	Cornbrash	25
			Forest Marble Formation	Forest Marble	25
			Blisworth Limestone Formation	Blisworth Limestone (White Limestone)	23
			Rutland Formation		
			Taynton Limestone Formation		
			Sharp's Hill Formation		
			Hosehay Sand Formation		
	Inferior Oolite Group		Northampton Sand Formation		
Lower Jurassic	Lias Group		Whitby Mudstone Formation		
			Marlstone Rock Formation	Marlstone	22

Building stones in geological order from the oldest through to the youngest layers.

2 The Use of Stone in Buckinghamshire's Buildings

Background and historical context

Buckinghamshire extends from the Ouse Valley and the beginnings of the Midlands landscape in the north, to the River Thames and the edge of London in the south. In between, dramatically delineated by the Chilterns scarp, are the Vale of Aylesbury and the Chilterns. Each area is very different in character and their historical development and the availability and use of building stone were very varied.

Overall, the county has nearly 5,900 listed buildings and 212 conservation areas. The earliest surviving remains of stone buildings date from the Roman period. They include the Romano-British settlement at Stantonbury, Milton Keynes, which comprises a wharf and various stone buildings.

During the medieval period, religious communities had a significant influence on the landscape, economy and the extraction and use of building stone in the county. More than 20 such communities are known to have existed. Missenden Abbey and Notley Abbey near Thame were large and wealthy establishments; the others tended to be small.

After the Dissolution of the Monasteries by Henry VIII, the buildings of many religious communities were systematically dismantled or sold for conversion into dwellings. Some buildings survive, including the Abbotts Lodging at Notley Abbey and the remains of Burnham Abbey. The latter were restored between 1913 and 1915 as an Anglican nunnery. Stone reused from monastic buildings can be found in several farms and also in domestic and church buildings.

Buckinghamshire has about 200 churches with remaining medieval fabric evident. They represent the largest body of extant medieval stone buildings in the county. Most churches were built piecemeal or altered and extended many times. Frequently, stone of varied origins from within and beyond the county was used during different periods and stages of their construction and repair. In the north, Blisworth Limestone is the dominant building stone, whereas Purbeck and Portland limestones were used for churches located on or near the Midvale Ridge, at Sherington, for example. There are a few churches of ironstone on the Greensand Ridge, especially in and around the villages of Great Brickhill and Little Brickhill.

Figure 4: Church of St Laud, Sherington. Blisworth Limestone with some Bath Stone dressings.

Flint was used in most of the pre-Reformation churches to the south of the Vale of Aylesbury and in the Chilterns, often with Totternhoe Stone (sourced from Bedfordshire) dressings. Flint was also the main material employed in the large number of churches constructed in the Chilterns during the 19th century. Here, imported stone was often used for the dressings. Sarsen stone was used occasionally in the Chilterns and the southern part of the Vale of Aylesbury.

Timber-framed construction predominated in secular buildings and few stone-built structures remain. The largest is the 14th-century Boarstall Tower, near Brill. It is the surviving gatehouse of a large moated house that was demolished during the later 18th century.

Timber framing predominated in the construction of farm buildings across the county until the 19th century, except in the north of the Vale and on the Yardley Whittlewood Ridge. Here, stone was often used until the 18th century, when brick, or in the Chilterns brick with flint, became increasingly dominant.

From the 17th century, re-facing and encasing of timber-framed manor houses using stone became fashionable, as seen, for example, at Little Loughton Manor near Milton Keynes.

Brick was produced at Brill on the Midvale Ridge from the 12th century, with floor tiles being manufactured at Tylers Green in the Chilterns from the 14th century. In the 16th century, brick started to be used for prestigious houses, such as Chequers, near Ellesborough, and Chenies Manor House. By the 18th century, brick was widely employed across the county. In the Chilterns, the use of brick and flint became increasingly frequent from the 18th century. However, timber framing and weatherboarding continued to be used into the mid-19th century.

From the 15th century, the proximity and ease of access of much of the county to London led to the development of numerous mansions and estates, frequently with associated parks and gardens. Notable concentrations are found in the Chilterns and South Buckinghamshire along the Thames Valley. As well Chenies and Chequers, they include Hampden, West Wycombe, Langley Park, Tyringham, Stowe and 19th-century estates such as the Rothschilds' Waddesdon, Mentmore, Eythrope and Halton homes in the Vale of Aylesbury.

Imported and local stone was often used in the construction of mansions and park and garden structures. Waddesdon Manor, for example, is constructed in Bath Stone. Mentmore is built in Ancaster Stone.

Figure 5: Waddesdon Manor, near Aylesbury. Bath Stone ashlar.

The late 19th and 20th centuries saw the rapid expansion of London into the Thames Valley and Chilterns, and the construction of Milton Keynes new town in the 1960s. Little use was made of stone in such development, apart from in occasional houses and mansions. Gothic Revival and Arts and Crafts architects, such as George Devey, C F A Voysey, Baillie Scott and William Caröe, often used stone. It was sometimes sourced from reopened historic quarries. These provided chalk, Sarsen stone and flint, but stone was also obtained from outside the county. Imported stone has continued to see occasional use during the late 20th century, particularly for facade cladding. For example, Stony Stratford bus station (built in 1982–3) is faced in Cornish Granite.

Natural Character Areas (NCAs)

Local landscape character and the combination of history, cultural and economic activity, geodiversity and biodiversity have been mapped for the whole of England and National Character Areas (NCA) defined (see Further Reading, Online Resources and Contacts). For each NCA there is a profile document which describes the natural and cultural features that shape the landscapes, how the landscapes have changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. The profiles include notes on local

vernacular and building materials which are expanded in the following section on the four NCAs covered in this guide:

NCA 88 Bedfordshire and Cambridgeshire Claylands
NCA 90 Bedfordshire Greensand Ridge
NCA 91 Yardley Whittlewood Ridge
NCA 108 Upper Thames Clay Vales
NCA 109 Midvale Ridge
NCA 110 Chilterns
NCA 115 Thames Valley

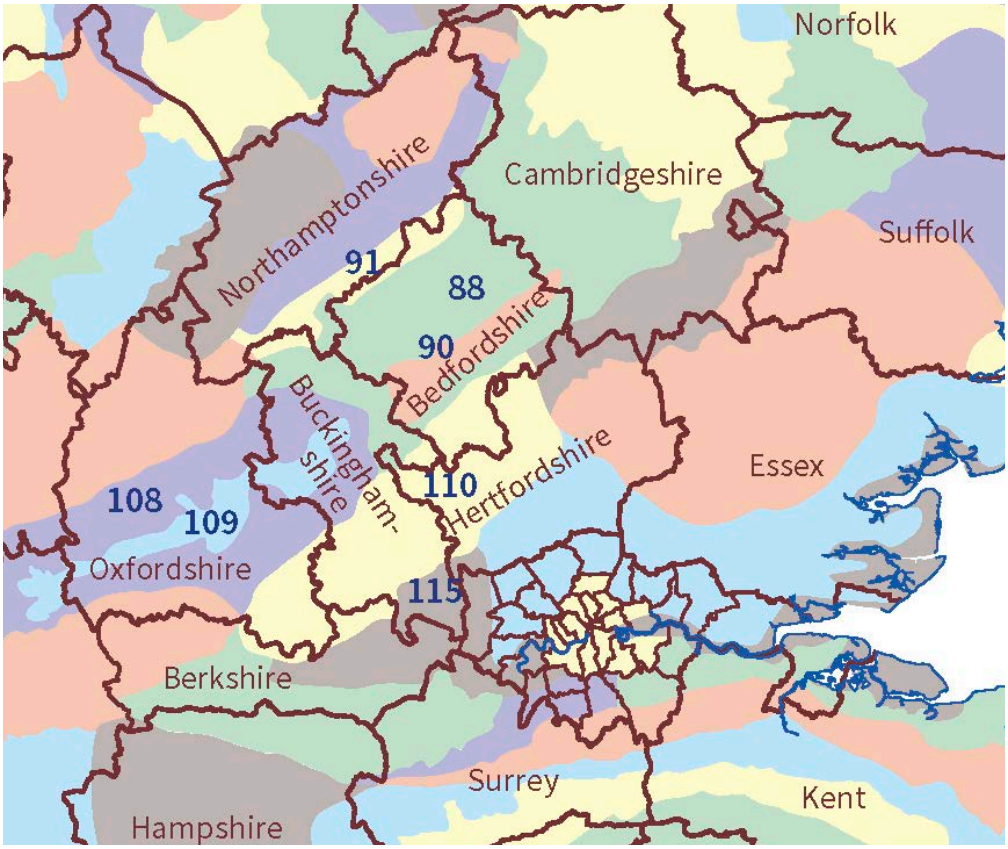


Figure 6: Map showing the National Character Areas (and the NCA numbers).

Bedfordshire and Cambridgeshire Claylands

The Bedfordshire and Cambridgeshire Claylands is a very large area that extends from the Fens to east Buckinghamshire.

The area of the Bedfordshire and Cambridgeshire Claylands that lies within Buckinghamshire is located to the north and east of the county and includes the settlements of Buckingham, Weston Underwood and Olney, the villages of Milton Keynes (such as Great Linford, Thornton, Whaddon and Old Wolverton), and the Newport Pagnell area. In the Bedfordshire and Cambridgeshire Claylands, there is a relative dearth of indigenous building stone. The vernacular building tradition was largely dominated by timber framing, although brick was produced from the 13th century, particularly in the area around Aylesbury.

Bedfordshire Greensand Ridge

The western end of the Bedfordshire Greensand Ridge occurs in south-eastern Buckinghamshire. Here, there is a dispersed settlement pattern to the small villages. Local building materials include the distinctive ochreous Brickhill Ironstone, which was often used in local churches, village walls and plinths to timber-framed buildings. However, some of this stone was probably sourced from nearby quarries at Heath and Reach in Bedfordshire. Among the best examples of local Brickhill Ironstone are the churches at Great Brickhill, Little Brickhill and Bow Brickhill. Here, the stone is used in combination with Totternhoe Stone, which was employed for random rubblestone walling, window and door dressings.

Figure 7: Church of All Saints, Bow Brickhill. Brickhill Ironstone with dressings of Totternhoe Stone and Middle Jurassic limestone.

Yardley Whittlewood Ridge

The northerly part of Buckinghamshire (running approximately from Buckingham to Olney) lies on the southern fringes of the limestone belt that stretches across England from Lincolnshire to Dorset. The Yardley Whittlewood Ridge is formed of Great Oolite Group limestone overlain by Quaternary sands, gravels and boulder clay.

The ridge's landscape history is markedly different to that of the Vale of Aylesbury to the south. During the 13th century, royal hunting forests were established at Yardley Chase, Salcey Forest and Whittlewood. These woodlands provided important sources of fuel and building materials, including timber and Great Oolite Limestone.

Settlements in this area are small and relatively few, consisting largely of nucleated 'forest villages' located on the edge of the forest and on the lower slopes of the plateau. They include villages constructed largely of stone, such as Hartwell, Ravenstone, Hanslope and Lillingstone Lovell. Blisworth Stone was quarried in the area and also in nearby Northamptonshire. It was the main stone used in a wide variety of surviving buildings dating from the 17th century onwards, including churches, manor houses, farm buildings, cottages, schools and village walls. Occasionally, Forest Marble and Cornbrash were also used in small quantities, for example in coursed walls at All Saints' Church at Ravenstone. Thatch was used as the main roofing material until the 19th century, although stone slates were occasionally used, for example in Turweston.

During the 19th century, following deforestation and enclosure, several 'model estate' farmsteads, either isolated or adjacent to villages, were constructed mainly in stone.

Figure 8: Terraced cottages, Ravenstone. Blisworth Limestone with Forest Marble and Cornbrash.

Upper Thames Clay Vales

The Upper Thames Clay Vales NCA extends from Bedfordshire to west Wiltshire. In Buckinghamshire the NCA stretches from Marsh Gibbon in the west to Cublington in the east of the county. This area includes the settlements of Haddenham, Aylesbury, Winslow, the Claydons and Ludgershall.

Figure 9: Cottages, Sherington. Blisworth Limestone.

There are occasional outcrops of Blisworth Limestone and Cornbrash. Building stone, particularly Blisworth Limestone, was often quarried in these areas, such as at Coombs Quarry near Thornborough. Quarries once existed at Gayhurst, Eckley, Olney and Bradwell near Milton Keynes. Several villages around Buckingham, Milton Keynes and Newport Pagnell, such as Sherington, are constructed largely of Blisworth Limestone.

In the north-east of the claylands area, there are further stone settlements around and including the town of Olney. During the medieval period, churches and structures such as bridges were generally built of stone, whereas other buildings were usually constructed in timber frame. From the 16th century onwards, many buildings, from mansions to cowsheds, were built in stone.

In the south-east of the claylands area, stone from the nearby Bedfordshire Greensand Ridge is often found in buildings, particularly in churches. All Saints' Church at Wing, one of the finest Anglo-Saxon churches in England, and St Michael's Church at Stewkley, the largest Norman church in the county, are built of coursed limestone with ironstone rubble. The latter also uses Quaternary glacial cobbles and pebbles. The Church of SS Peter and Paul at Wingrave, to the east of Aylesbury, contains small quantities of Wingrave Puddingstone.

Across much of the NCA, timber framing and thatch were the traditional building materials. To the north of the Midvale Ridge, cruck frame buildings are common, although stone buildings are also present in areas near to the Midvale Ridge, the Cotswolds (to the west) and the Chilterns (to the

south). Occasionally, villages with significant numbers of stone buildings are encountered, such as Marsh Gibbon to the north of the Midvale Ridge and Haddenham to the south. Many of Haddenham's buildings are constructed of Purbeck Limestone or Portland Limestone blocks, even though the village is renowned for the extensive use of witchert, a 'white earth' made from local calcareous clay subsoil.

Figure 10: A restaurant, Churchway, Haddenham. Portland Limestone (Buckinghamshire type).

Figure 11: Garden wall, Haddenham. Witchert.

Figure 12: Wall detail, Haddenham. Witchert.

Many large farmhouses survive. Some are medieval, although most appear to date from the 16th century. Typically, they originated as timber-framed buildings, but have been re-fronted or encased using brick, stone or lime render.

During the 17th and 18th centuries, many earlier manor houses and large houses were rebuilt or encased in stone. Timber, rendered brick and imported stone were often used for dressings and quoins due to the softness of the local stone. Often, the remodelling was extensive, as seen, for example, at Great Linford, near Milton Keynes, and Hartwell House, to the west of Aylesbury.

In the north and east of the NCA, farm buildings were often built in stone. During the 17th century and up until the mid-18th century, many new barns were built and existing barns were modified to increase processing capacity and storage space for crops. This area has some of the best-preserved examples of 18th and 19th-century parliamentary enclosure landscapes in England. Enclosure led to a change from arable and mixed farming to dairy farming, which necessitated the adaption of existing buildings or the construction of new ones. These were usually timber framed and weatherboarded, or brick-built and roofed in Welsh slate or plain tile.

The Vale of Aylesbury also contains some of the most important designed landscapes in England. They include Stowe and the group of Rothschild parks around Aylesbury, as well as parks such as Hartwell and Gayhurst. Extensive use was made of a range of indigenous and imported stone in their structures. The most significant garden, Stowe, has over 30 listed buildings and structures, many in both indigenous and imported stone, including limestone ashlar and rubblestone, flint and ironstone.

Brick and tile became dominant across much of the Vale of Aylesbury from the 18th century, with the rise in locally produced materials. Significant brick and tile-producing industries emerged at Brill and Calvert, near Steeple Claydon, on the Midvale Ridge for example, and further east at Great Linford. Improved transportation stemming from the development of canals and turnpikes, and subsequently railways, facilitated the use of brick and slate across the Vale from the 18th century.

Icknield Belt and Chalk Foothills

The area of relatively low-lying hills of Cretaceous gault clay, greensand and grey chalk, lies between the foot of the white chalk of the Chilterns scarp and the claylands of the Vale of Aylesbury to the north has a distinct building stone history.

Small settlements and market towns located along the foot of the chalk scarp are characteristic of the area. They include Princes Risborough, Monks Risborough, Great and Little Kimble, Wendover, Halton, Drayton Beauchamp, Pitstone, Ivinghoe and Edlesborough.

The area provided some chalk block or 'rag' (from the nearby Aston Clinton Ragpits), Sarsen stone and Quarry Flint as building stone. However, the vernacular building tradition was largely dominated by timber framing and brick, the latter of which was produced and used from the 13th century onwards. Farm buildings often have chalk rag or brick plinths and are clad in weatherboarding, sometimes with stone quoins, such as at Manor Farm Barn, Little Kimble.

Pre-Reformation churches in the area were generally built of a mixture of materials. For example, the 12th-century Church of All Saints at Little Kimble is constructed of variously sized knapped and unknapped random flint nodules and chalk rag, with some Sarsen stone and Totternhoe Stone dressings. Chalk and flint chequerwork is displayed in the tower of St Mary's Church at Drayton Beauchamp, in chequerboard cottages on Wycombe Road in Princes Risborough and at Anderdons Farmhouse near Longwick. The 16th-century dovecote at Monks Risborough is built of chalk block and rubble.

Figure 13: Cottage, Princes Risborough. Quarry Flint and chalk block chequerwork.

Figure 14: Dovecote, Monks Risborough. Chalk block and rubblestone.

Quarry Flint was utilised throughout much of the area, for example in houses, workers' cottages and medieval churches, such as the Church of St Mary at Ivinghoe. Mixed flint and brick are most commonly found west of Wendover. Flint was used knapped, and less frequently as cobbles, for example in several buildings in Weston Turville, and as the main material for 19th-century large houses such as Ramblers, Buckland.

Sarsen stone was also used occasionally. For example, the impressive Church of St Michael and All Angels at Halton was built of squared Sarsen stone blocks, probably sourced from High Wycombe, and exhibits large flint flake galleting in the mortar joints.

Midvale Ridge

The Midvale Ridge lies between the two areas of claylands that form the Vale of Aylesbury. It extends from Whitchurch west into Oxfordshire and Wiltshire and includes the settlements of Quainton, Waddesdon, Long Crendon and Brill. The ridge is formed of a discontinuous outcrop of Upper Jurassic Portland and Purbeck limestones and capped by Lower Cretaceous Whitchurch Sandstone.

Locally quarried Portland and Purbeck limestones were commonly used as building material in villages and settlements along the ridge top or just above the low-lying ground of the adjacent vale. Ickford, Long Crendon, Chearsley, Upper Winchendon, Cuddington and Oving tend to have buildings constructed in a variety of materials, including timber frame, brick and witchert. These often have stone plinths, although complete brick or stone buildings are also common. Thatch or plain tiles are widely used as roofing materials, with slate becoming common from the 19th century onwards. Long Crendon has a substantial number of Purbeck Limestone buildings. Here, stone was occasionally used to replace daub in panels in timber-framed buildings. Other stone buildings in the village include the Manor, which has brick dressings and a 15th-century stone gatehouse, and the nearby Notley Abbey House and Notley Farm tithe barn.

Outlier hills capped by Lower Cretaceous Whitchurch Sandstone occur around Brill, Whitchurch, Stone, Chilton, Waddesdon and Ashendon. These red, iron-rich sandstones have been used in many of the older buildings and walls in these villages, most notably at Brill.

A pottery and tile industry developed at Brill utilising local Whitchurch Sandstone and clays. It started during the Roman period and continued until the 19th century. Brick was produced by a cottage industry from at least the 13th century and production expanded considerably during the 19th century.

Enclosures and reorganisation of farmland during the 18th and 19th centuries saw the introduction of large regular fields and the construction of new farms and farm buildings.

Figure 15: Roadside wall, Brill. Whitchurch Sandstone.

Chilterns

The Chilterns are a range of hills that reach up to 260m above sea-level and extend from Goring-on-Thames north-eastwards to Cambridgeshire. They are formed of Cretaceous chalk, with their main scarp located on the north-western side of the outcrop. To the south of the scarp, the Chilterns plateau and dipslope fall gradually towards the Thames Valley. Here, the chalk is overlain with extensive deposits of glacial clay-with-flints and other sands and gravels laid down during the Anglian glaciation around 400,000 years ago. The Chilterns produced five main types of local stone: chalk, Quarry Flint, Quaternary Flint, Sarsen stone and Bradenham Puddingstone.

Timber framing with thatched roofing was dominant in the medieval period. Flint was used in all the pre-Reformation churches of the area and in a wide range of buildings, from town houses to barns. Sometimes, Sarsen stone or puddingstone was used for foundation blocks or cornerstones.

There is a significant concentration of 18th and 19th-century mansions and associated parks and gardens, particularly to the south-east of the Chilterns, reflecting the area's proximity to London and Windsor. Most of the mansions were constructed of imported stone or brick, although some use was made of chalk, flint and Sarsen stone. By 1820, there were approximately 600 parks. Flint was often used for structures such as Gothick cottages, gazebos, grottos and follies. The flint buildings of West Wycombe Park, where idiosyncratic experimental forms of flintwork were used, were particularly influential. For example, the Dashwood Mausoleum, West Wycombe, uses decorative flintwork for its quoins, in place of the rock-faced quoins usually used in classical buildings, and the entrance to the Hellfire Caves, also West Wycombe, has a flint triptych façade and side walls.

Figure 16: Hellfire Caves, West Wycombe. Flint rubble.

During the 19th century, some large estates, particularly in the south-east of the county, were split, fuelled by the demand by rich industrialists for new country houses that were within easy reach of London. For example, at Medmenham (west of Marlow) three new properties were created in 1895–6 by splitting the former Medmenham Abbey Estate. Two new houses, Danesfield (for Robert Hudson, the soap manufacturer) and Whittington (for Hudson Kearley, founder of International Tea Company's Stores), were built.

Timber framing was used for barns and other farm buildings, such as hay stores, cart and implement sheds, granaries and livestock housing. They were often built on brick bases and sometimes incorporated Sarsen stone in the footings. In conjunction with brick, flint became the dominant building material of the area from the 18th century onwards.

The 19th-century expansion of the railway network led to a rapid growth in population. A large number of Anglican churches were built or rebuilt to serve the increased population. They were largely constructed of local flint, often with imported stone dressings. Non-conformism was established early in the Chilterns. There is a particularly rich legacy of 18th and 19th-century chapels.

Brick was produced locally from the 15th century and became the dominant building material of the area from the 18th century. Chilterns flint was commonly used in combination with brick, especially in the central plateau areas of the Chilterns. Here, it can be found in 17th-century farmhouses and 18th-century cottages, and universally from the late 19th century. Clay tiles were used as the general roofing material from the 16th century onwards. However, thatch remained in use on humbler buildings. Welsh slate became commonplace during the 19th century due to improved transportation, brought about by the construction of turnpikes, the Grand Junction Canal and the railway system.

Thames Valley

Part of the Thames Valley, comprising the stretch of the Thames floodplain to the south of the Chilterns, lies within Buckinghamshire. It includes the area south of Beaconsfield towards Eton Wick and westwards to the River Colne. Settlements include Gerrards Cross, Chalfont St Peter, Iver and Datchet. The underlying geology is mainly of London Clay, overlain by Quaternary alluvium and gravel deposits.

From the late 17th century onwards, timber frame was dominant, with brick being used in numerous smaller houses and farms. Flint was also extensively used in medieval churches, often in combination with a range of other materials. For example, the Church of St Peter at Iver, the Church of St Mary at Burnham and the Church of St Mary at Wexham variously employed locally sourced Quaternary Flint, False Puddingstone (ironstone conglomerate) and Quaternary glacial pebbles and cobbles in their construction, along with Roman brick and imported Jurassic limestones. The limestones were used mainly for quoins, mullions and other decorative features.

Figure 17: Church of St Mary, Burnham. Quaternary Flint, with knapped flint, False Puddingstone and glacial pebbles and cobbles.

3 Local Building Stones

Buckinghamshire has a varied geological succession that encompasses strata ranging from early Jurassic to early Tertiary age. The northern half of the county comprises mainly Middle and Upper Jurassic sedimentary rocks, whereas the southern half comprises variably consolidated Cretaceous and Palaeogene deposits. In many parts of the county, the bedrock has an extensive cover of largely unconsolidated Quaternary glacial deposits and recent alluvial sediments.

The bedrock succession of the county comprises a diverse sequence of interbedded mudstones, sandstones, limestones and chalks with flints. Historically, many of these rock types were exploited to provide local building materials and they were worked at several locations within the county, albeit usually on a relatively small scale.

Blisworth Limestone from the Middle Jurassic part of the succession is still quarried at the only remaining limestone quarry in Buckinghamshire: Weston Underwood Quarry, near the county border with Northamptonshire. Portland Group and Purbeck Group limestones were formerly quarried at various locations in the Vale of Aylesbury, including at Long Crendon, Hartwell, Dinton and Cuddington. Lower Greensand Group ironstones (Carstone) were used very locally along the eastern border of the county, and Palaeogene quartz-cemented Sarsen stones were commonly employed as a building stone in the Chilterns.

Lower Jurassic

Lias Group, Marlstone Rock Formation

Marlstone

In Buckinghamshire, Lower Jurassic sedimentary rocks assigned to the Lias Group are thinly developed and very poorly exposed. They crop out only to the north-west of Milton Keynes, between Little Linford, Stony Stratford and Pindon End (along the county border with Northamptonshire), and are usually concealed by unconsolidated Quaternary and recent sediments. Where exposed, the Lias Group strata principally comprise grey, variably fossiliferous, calcareous mudstones, with thinly interbedded paler coloured limestones. A small inlier of orange-brown, iron-rich, sandy limestone, Marlstone occurs in the area of worked ground between Little Linford and Great Linford.

The very limited development of Lias Group strata in Buckinghamshire has resulted in its almost negligible use as a building stone. Reports of Marlstone in buildings in Olney, such as the church hall, have not been confirmed during this study. The ironstone blocks observed in walls in Olney lack any characteristic Marlstone fossils, such as belemnites and large pectinid bivalves, and they are instead thought to originate from within the Inferior Oolite Group of Northamptonshire (that is, the Northampton Sand Formation) or possibly to be a variant of Whitchurch Sandstone.

Figure 18: Olney Church Hall, Olney. Blisworth Limestone with Marlstone and weathered ironstone.

Middle Jurassic

Great Oolite Group, Blisworth Limestone Formation

Blisworth Limestone (White Limestone)

The Blisworth Limestone Formation forms part of the Great Oolite Group, which is a moderately thick succession of Middle Jurassic limestones. Blisworth Limestone has been worked and used extensively as a building stone in many towns and villages located within its outcrop in northern Buckinghamshire, notably in Lavendon, Olney, Sherington, Emberton, Weston Underwood, Ravenstone, Stoke Goldington, Gayhurst, Great Linford, Stony Stratford, Thornborough and Buckingham.

The Blisworth Limestone Formation comprises pale yellow to pale grey, variably ooidal and bioclastic limestones, which in places exhibit cross-stratification and laminations. The latter become particularly pronounced towards the top of the unit, as it passes vertically upwards into the more laminated and rubbly limestones of the Forest Marble Formation and the Cornbrash Formation. In the area to the west of Milton Keynes, the Blisworth Limestone Formation passes laterally into the White Limestone Formation, which is lithologically similar but is characterised by very pale coloured, whitish limestones (as its name implies). These limestones can be seen in association with the Blisworth Limestone in the nave and tower of the Church of SS Mary and Giles at Stony Stratford.

Figure 19: Thornborough Bridge, Thornborough. Blisworth Limestone.

Figure 20: Thornborough Bridge, Thornborough. Blisworth Limestone blockwork.

Great Oolite Group, Forest Marble Formation and Cornbrash Formation

Forest Marble, Cornbrash

The upper parts of the Great Oolite Group in northern Buckinghamshire include a thin succession of pale grey to buff-coloured, laminated and rubbly limestones, which are assigned to the Forest Marble Formation and the Cornbrash Formation. Distinguishing between these limestones and those of the Blisworth Limestone Formation is not always easy in stone walls, but typically these younger limestones are more laminated and rubblier in appearance than Blisworth Limestone. The Cornbrash Formation also contains occasional beds packed with thick-shelled bivalve and brachiopod fossils.

The Forest Marble Formation and the Cornbrash Formation have a broadly similar outcrop pattern and occurrence to the Blisworth Limestone Formation but tend to be less used for building. However, examples can be seen in Ravenstone village, especially in the walls around the churchyard and bus stop.

Figure 21: Churchyard wall, Ravenstone. Forest Marble and Cornbrash with Blisworth Limestone and ironstone.

Figure 22: Churchyard wall, Ravenstone. Forest Marble and Cornbrash with Bilsworth Limestone and ironstone.

Upper Jurassic

Portland Group, Portland Stone Formation

Portland Limestone (Buckinghamshire type)

Although pits dug into Portland Group strata were common in Buckinghamshire during the 20th century, few exposures remain today. However, Portland Limestone and the fossils it contains (notably large ammonites of titanites type) can be seen over much of mid-Buckinghamshire, where it has been extensively used as the local building stone of choice. The lower half of the Portland Group in this area comprises mainly mustard-yellow weathering sands, which are too soft for building purposes; the upper half is represented by a series of cream, buff or pale grey to orange-grey limestones, which are sandy in places and vary from very fine grained to gritty in texture. Some beds are highly fossiliferous and contain abundant small gastropods and bivalves in addition to (often large) ammonites. Fossils used for decorative purposes are occasionally encountered in walls. Particularly noteworthy examples include large ammonites (of titanites type) from the Portland Limestone, which are used in the boundary walls of Hartwell Park, and sea urchins contained in flint nodules, which feature within the walls of the Church of St Peter at Iver.

Figure 23: Bridge wall at Hartwell House, near Aylesbury. Large ammonite (titanite type).

Figure 24: Church of St Peter, Iver. Fossil sea urchin in a flint nodule.

The buff colour and sandy nature of the Buckinghamshire Portland Limestone readily distinguishes it from the whitish, more evenly grained, homogenous Portland Stone that occurs on the Isle of Portland in Dorset and that has seen use across southern England.

Portland Group strata crop out in a belt extending through central Buckinghamshire, from Brill, Boarstall and Long Crendon in the west (adjoining Oxfordshire), through Upper Winchendon, Aylesbury and Hulcott to Oving and Wing in the east (near the county border with Bedfordshire). Portland Limestone is employed in many towns and villages throughout central Buckinghamshire. Particularly fine examples can be seen in Cuddington, Dinton, Dunton, Haddenham, Long Crendon, Oving, Whitchurch and Wing.

Figure 25: Church of St Mary the Virgin, Haddenham. Portland Limestone (Buckinghamshire type) and Purbeck Limestone (Buckinghamshire type).

Figure 26: Church of St Mary the Virgin, Haddenham. Portland Limestone (Buckinghamshire type).

Figure 27: Cottages, Aylesbury Road, Cuddington. Portland Limestone (Buckinghamshire type) rubblestone.

Purbeck Group, Purbeck Formation

Purbeck Limestone (Buckinghamshire type)

In western Buckinghamshire, the Purbeck Group has a similar but more limited outcrop area to the underlying Portland Group. The unit is little developed to the east of Aylesbury. There are currently no significant exposures of Purbeck Group strata in the county, although historically they were worked at several pits, notably at Hartwell and Long Crendon. Blocks of Purbeck Limestone also occur as field brash on top of the ridges formed by Portland Group rocks at Dinton and Upper Winchendon.

The Purbeck Group is relatively thin in Buckinghamshire and its occurrence in the county represents the most north-easterly development of Purbeck strata in England. The succession comprises thinly bedded, fine-grained, pale grey to grey limestones and marls. The limestones tend to be more flaggy (more laminated) in character than those of the Portland Group and they contain algal stromatolites and freshwater gastropods and bivalves. Various walls in the villages of Cuddington and Haddenham provide some of the best examples of the use of Purbeck Limestone in the county.

Figure 28: Church of St Mary the Virgin, Haddenham. Purbeck Limestone (Buckinghamshire type).

Cretaceous

The Lower and Upper Cretaceous succession is extensively developed in the southern half of Buckinghamshire. The Lower Cretaceous is represented by a lithologically varied, condensed stratigraphic succession dominated by interbedded ferruginous sandstones and ironstones. In contrast, the Upper Cretaceous is dominated by chalky limestones, some of which contain flints.

Lower Cretaceous

Wealden Group, Whitchurch Sand Formation

Whitchurch Sandstone, Bowel Stone

The oldest Cretaceous strata occurring in Buckinghamshire are assigned to the Whitchurch Sand Formation. These crop out as a series of outliers that cap the small hills between Aylesbury and Boarstall. The formation was formerly quarried at Long Crendon and Brill, where a thickness of 18m is developed. It comprises a lower succession of silts and clays, which are overlain by fine to medium-grained ferruginous sandstones and ironstones; some of the sandy beds contain glauconite. The colour of the sandstones varies from greenish-grey to deep orange-brown. The beds contain few fossils, which are represented mainly by non-marine bivalves and gastropods.

The better cemented and more durable sandstone and ironstone lithologies within the formation have been used locally and on a small scale as a general walling and rubblestone, especially in older buildings, walls and rockeries. The village of Brill provides some of the best examples in Buckinghamshire. Here, some beds of Whitchurch Sandstone were sufficiently durable to be worked, and the resulting blocks were used to produce roughly coursed walls. However, the softer sandstones are very susceptible to weathering, which typically exploits laminations or areas around harder iron-rich layers. The weathered surfaces of isolated blocks often exhibit a purple-black colouration.

The Whitchurch Sand Formation crops out far more extensively in the adjacent county of Bedfordshire, where it was widely quarried both as an iron ore and a building stone. It is, therefore, likely that some of the Whitchurch Sandstone used in Buckinghamshire was imported.

Figure 29: Wall near The Pheasant, Brill. Whitchurch Sandstone.

Figure 30: Cottages, Church Street, Brill. Whitchurch Sandstone.

Bowel Stone is the name given to greyish, hard, rounded, irregular siliceous concretions that occur in the lower silty part of the Whitchurch Sand Formation. Some concretions assume quite 'grotesque' forms, which has been reflected in their name. Individual stones typically vary from about 200mm to 600mm in length, although larger stones may occur occasionally.

Bowel Stone is seldom encountered. Its use as a walling stone is sporadic and it has been employed mainly for decorative purposes. Good examples can be seen in the walls around Hartwell Park, adjacent to the main A418 road between the villages of Hartwell and Stone.

Figure 31: Roadside wall, Hartwell Park, Aylesbury. Bowel Stones in Portland Limestone (Buckinghamshire type).

Lower Greensand Group, Woburn Sands Formation

Brickhill Ironstone (Carstone)

The Buckinghamshire outcrop of the Woburn Sands Formation is confined to a small area in the east of the county. This area takes in the Brickhill villages and extends as far north as Woburn Sands on the county border with Bedfordshire. The strata comprise distinctive red-brown, orange-brown or dark greenish-brown, highly ferruginous sandstones and ironstones, which are typically medium to coarse grained. Individual weathered blocks often exhibit coloured Liesegang banding, along with resistant purple-black-coloured veins, stringers and laminations of various iron compounds.

These ironstones are much used locally as a general walling stone and feature in many houses, roadside walls and churches in Soulbury, Stoke Hammond, Great Brickhill, Little Brickhill, Bow Brickhill, Wing and (to a lesser extent) Stewkley. In local churches where Brickhill Ironstone is employed as the main walling stone, it has often been roughly worked into tabular blocks.

The distinctive colour of this stone fabric contrasts strongly with the associated chalk block, Totternhoe Stone or Middle Jurassic limestones used in the same buildings for dressings, irregular fill or decorative purposes. The stone was particularly favoured by Gothic Revival architects during the 19th century and was the main stone used in the construction of William Butterfield's parsonage at Wavendon and Benjamin Ferrey's vicarage at Mentmore.

Figure 32: Church of All Saints, Bow Brickhill. Brickhill Ironstone.

Figure 33: Church of St Mary the Virgin, Great Brickhill. Brickhill Ironstone.

Upper Cretaceous

The Upper Cretaceous Chalk Group forms a broad belt runs roughly north-east to south-west across Buckinghamshire. This extends approximately from Princes Risborough to Medmenham in the west, and Weston Turville and Chalfont St Giles in the east, and forms the scarp face of the Chilterns. The Chalk Group succession attains a total thickness of about 300m. It is divided into a thinner lower unit: the Grey Chalk Subgroup, or 'Lower Chalk', which has a relatively high clay content and contains marls but no flint, and a thicker upper unit, the White Chalk Subgroup, or 'Middle and Upper Chalk', which comprises nearly pure chalk and contains abundant flint.

Chalk Group, Grey Chalk Subgroup, Zig Zag Chalk Formation

Totternhoe Stone

The Totternhoe Stone Member varies in thickness from approximately 0.5 to 2m. Locally, it may reach up to 5 or 6m, but the base and top of the unit may grade into the adjoining chalk deposits and thus the boundaries can be difficult to recognise. Totternhoe Stone is a distinctly harder unit of chalk within the Grey Chalk Subgroup and typically comprises fine-grained, creamy to pale brownish-grey, chalky calcarenites. It often appears 'sandy' due to the presence of coarse fossil fragments. The unit varies from thin to thickly bedded and is phosphatic in parts. Some beds contain characteristic dark brown phosphatic pellets up to a few millimetres across, which occasionally become nodular and attain sizes of several centimetres across.

Overall, the use of Totternhoe Stone in Buckinghamshire appears to have been quite limited. Houses and other buildings constructed of the stone in a variety of styles can be seen at Aston Clinton, Bierton, Ellesborough, Hambledon, Longwick, Princes Risborough and Turville. Totternhoe Stone was also employed in several churches, including the Church of St John the Baptist at Little Marlow and the Church of St Mary at Ivinghoe, the latter of

Figure 34: Church of St Mary, Great Brickhill. Totternhoe Stone windows with Bath Stone repairs.

which was built on a knoll of Totternhoe Stone and utilises the stone in its fabric. Totternhoe Stone was used in decorative fashion around windows and doors in churches at Great Brickhill, Little Brickhill and Bow Brickhill.

The proximity of the once-famous Totternhoe Stone quarries near Dunstable in Bedfordshire has doubtless resulted in the importation of Totternhoe Stone into Buckinghamshire. For example, such stone was certainly used at Edlesborough.

Quarry Flint (Fresh Flint)

Quarry Flint is one of the most common and widely used building stones in Buckinghamshire. It originates from bands and more isolated nodules of flint that occur within the chalky limestone beds of the White Chalk Subgroup. Quarry Flint was dug from chalk pits and has been used extensively close to and within the outcrop area of this bedrock unit.

Quarry Flint is an extremely fine-grained (cryptocrystalline) and hard form of silica, containing microscopic quartz-crystal aggregates. It usually occurs as irregularly shaped nodules that are 100 to 200mm across, or as (sub-) rounded pebbles and cobbles. Occasionally, it is also found as weakly banded tabular sheets or layers up to 200mm thick. The colour is very distinctive: fresh flint nodules have a white outer cortex with a black or dark grey interior.

Quarry Flint breaks with a characteristic conchoidal fracture, producing razor-sharp fine edges. The cleaved surfaces may exhibit banding resulting from the alternation of layers of slightly different composition. Flint nodules may contain cavities lined with translucent botryoidal chalcedony or small transparent quartz crystals. Some flints contain well-preserved fossils, with echinoids, sponges, bivalves and burrow structures being the most commonly encountered types.

Quarry Flint is used very extensively in walls throughout Buckinghamshire in a wide variety of ways: laid to course as rough tabular ‘sheets’ of nodules; in squared chequerwork; or as knapped, faced, trimmed or cleaved-faced stone in random and decorative arrangements, including panels. Many churches in the county employ flint in one form or another, and the stone was used extensively in many villages.

Examples of the use of Quarry Flint can be seen at the Church of St Peter at Iver, the Church of St Mary at Burnham and the Church of St John the Baptist at Little Marlow (the last features a mix of Quarry and Quaternary Flints). The spectacular use of Quarry Flint (and Quaternary Flint) together with chalk block can be seen in walls of the Church of SS Peter and Paul at Medmenham. Here, several styles of flint knapping and decoration are evident, including large flint galleting. One of the more recent additions to the stone-built architecture of Buckinghamshire is the ultra-modern Flint House on the Rothschilds’ Waddesdon Estate. The house is encased in a layered fabric of white, grey and black, irregular and dressed flint nodules.

The extremely hard and resistant nature of Quarry Flint nodules has resulted in them being recycled by natural processes into younger deposits. These reworked types of flint, which show specific characteristics, are described below in the Quaternary section of this guide.

Figure 35: St Mary's Church, Burnham. Quarry Flint and Jurassic limestone, including Portland Limestone (Buckinghamshire type), chequerwork.

Figure 36: St Mary's Church, Burnham. Decorative flintwork.

Chalk Group, White Chalk Subgroup, various formations

Chalk (Chalk Block, Clunch, Rag)

The white chalky limestones of the Upper Cretaceous White Chalk Subgroup are among the most distinctive and easily recognised building stones employed in Buckinghamshire. They are white to very pale grey, typically structureless limestones, which in places contain fossil oysters and sea urchins, and occasionally crinoids, brachiopods and belemnites.

Chalk is generally unsuitable for exterior stonework because repeated wetting and drying (coupled with frost action) causes the relatively soft rock to powder and disintegrate into small angular brash. Softer forms of the stone, when used externally, may show concave weathering away from mortar lines.

Chalk has been sporadically quarried as a local source of building stone across much of its outcrop, although its use is relatively limited. Where employed, chalk is typically used as a rough walling stone, often accompanying other stones, especially flint, or for decorative purposes, as window dressings, banding and so forth. The stone may be roughly cut, which has enabled the creation of areas of squared blockwork, but walls constructed entirely of chalk block are uncommon. The 19th-century cottages at Bockmer End, Medmenham, provide a rare example.

Other noteworthy examples of the use of chalk include the Church of St Mary at Drayton Beauchamp (where chalk block is used in chequerwork with Quarry Flint on the tower), Windsor Lodge off Cliveden Road, Taplow, and All Saints' Church at Little Kimble (which incorporates local Portland Limestone, Sarsen stone, Quarry Flint and chalk rag from the nearby Aston Clinton Ragpits). One of the most spectacular uses of chalk block ashlar in Buckinghamshire is seen at Danesfield House Hotel, near Medmenham.

Figure 37: Danesfield House, Medmenham. Chalk block.

Elsewhere, particularly in western and southern parts of Buckinghamshire, chalk block may have been sourced from adjacent counties, especially south Oxfordshire or Berkshire.

Figure 38: Cottages, Bockmer End, Medmenham. Chalk block.

Figure 39: Cottages, Bockmer End, Medmenham. Chalk block ashlar.

Figure 40: Church of St Peter and St Paul, Medmenham. Quarry Flint and chalk block with Bath Stone dressings.

Figure 41: Detail of wall, Church of St Peter and St Paul, Medenham. Chalk block and Quarry Flint.

Tertiary

Lambeth Group, Upnor Formation and Reading Formation

Bradenham Puddingstone (Puddingstone, Conglomerate)

Bradenham Puddingstone is best seen at Bradenham village, where large blocks occur around the edge and roadside of the village green. The stone is very distinctive. It is a clast-supported breccio-conglomerate, containing sub-rounded to sub-angular pebbles of flint that exhibit grey interiors or (often) yellow-orange cores. The size of the pebbles varies considerably even within the same block, but typically ranges from 20mm to 80mm. The pebbles are cemented by relatively uniform grey quartz. It is believed that this puddingstone was formed in the coarser grained sediments of the Upnor Formation or the Reading Formation, and the clustering and sorting of the pebbles indicate that it may have been a fluvial or river deposit.

Although very hard and durable, its limited occurrence means that Bradenham Puddingstone is seldom used as a building stone, and when encountered it is usually found as irregular, isolated blocks in walls. Occasional examples can be seen in the wall fabric of the Church of St Botolph at Bradenham and in the roadside walls leading to Hartwell Park.

Figure 42: Church of St Botolph, Bradenham. Bradenham Puddingstone with Quaternary Flint nodules.

Figure 43: Bradenham village green. Bradenham Puddingstone boulder.

Quaternary

Various groups, various formations

False Puddingstone (Ironstone conglomerate, Iver Puddingstone, Wingrave Puddingstone types)

False Puddingstone is the name given here to breccio-conglomerates that have an overall deep purple-red colouration and contain a mixture of sub-rounded, dark reddish-grey flint pebbles and angular, orange-brown clasts and flakes of flint and chert. The iron-rich cement is invariably deep red-purple or even blackish coloured. False Puddingstone is readily distinguished

from Bradenham Puddingstone by its overall darker colour and deep red-purple iron-rich cement. Bradenham Puddingstone is a generally paler stone and possesses greyish quartz cement.

Iver Puddingstone is a variety of False Puddingstone. It is clast-supported and has a higher proportion of clasts to matrix. The clasts comprise angular orange-brown flint or chert and are associated with occasional small rounded pebbles of white quartz. Another variety, Wingrave Puddingstone has a higher proportion of matrix to clasts. The clasts comprise orange-brown flint or chert and lack white quartz pebbles.

False Puddingstone is a relatively hard, durable rock, but it has a scattered occurrence and does not appear to have been a very common or reliable source of building material. The best examples of its use are St Peter's Church at Iver, the Church of St Mary at Burnham and the Church of SS Peter and Paul at Wingrave.

Figure 44: St Peter's Church, Iver. Iver Puddingstone.

Figure 45: Wingrave Puddingstone (left); Iver Puddingstone (right).

Figure 46: Church of St Peter and St Paul, Wingrave. Portland Stone (Buckinghamshire type), with False Puddingstone and glacial pebbles and cobbles.

Figure 47: Church of St Peter and St Paul, Wingrave. Wingrave Puddingstone.

Sarsen Stone (Greywether, Denner Hill Stone, Quartzose Sandstone, Silcrete)

Loose blocks of hard, quartzitic sandstone known as Sarsen stone can be found in small clusters throughout the Chilterns, and notably in and around Denner Hill. It typically occurs as rounded or elongate pebbles, cobbles, boulders or even metre-scale isolated slabs (up to 2m in length). It is grey to pale brown in colour, becoming distinctly creamy-buff when weathered, and possesses a very fine-grained saccharoidal texture, comprising sub-rounded quartz grains set within a silica matrix, which is visible on fractured surfaces. Sarsen stone is very hard and resistant to weathering. Its surfaces are often smooth and may occasionally show poorly defined bedding structures.

Quarrying Sarsen stone was once a small but thriving local industry in the Chilterns. At Denner Hill, Sarsen stone was originally dug rather than quarried. The stone was also extracted between Prestwood and Hughenden, particularly at Naphill and Walters Ash.

Sarsen stone can be seen in buildings in the south of the county at Chenies, Halton and Wendover, as well as in villages and estates near Denner Hill. In the 18th to 20th centuries, architects sometimes specified Sarsen stone for

major works. For example, at Wycombe Abbey, James Wyatt re-faced the house and added the north block in Denner Hill Stone with flint galleting. William Caröe used the same material for his additions to Wycombe Abbey, adding a chapel and music school between 1898 and 1926.

Sarsen stone was also used as cornerstones, doorsteps, stepping stones, mounting blocks, gate posts and plinths, or as foundation stones in churches, cottages and farm buildings. Examples of Sarsen stone plinths and footings can be seen in Great Missenden (along the High Street and at the Church of SS Peter and Paul), Little Marlow (the Church of St John the Baptist) and West Wycombe (the Church of St Lawrence). At St Lawrence's, the tower and adjoining walls contain many blocks of Denner Hill Stone. The same stone was also used for kerbing or paving in towns such as Princes Risborough, Marlow and High Wycombe.

The Church of St Michael and All Angels at Halton, which is constructed entirely of precisely squared blocks of pale grey Sarsen stone, galleted with small black flint fragments in the mortar, provides one of the best examples of the use of Sarsen stone in Buckinghamshire. The precision cutting and setting in the fabric of the Sarsen stone blocks is unique in the county.

Figure 48: Church of St Michael and All Angels, Halton. Sarsen stone and flint.

Figure 49: Detail of the walls of the Church of St Michael and All Angels, Halton. Sarsen stone blocks with flint galleting.

Quaternary Flint (Field Flint, Brown Field Flint, Clay-with-flints)

Quaternary Flint typically occurs as irregularly shaped nodules on the field surface, in clay-with-flints or as pebbles in river terrace gravels and other superficial deposits. The size of the nodules ranges from 100 to 300mm, although larger nodules occasionally occur. The colour is variable: less weathered flint nodules or pebbles have a cream outer cortex with a darker coloured (greyish) interior; weathered flints, or those that have lain in soil or superficial deposits for a long period, may be variously discoloured or bleached, and often have brown-stained interiors due to the precipitation of iron hydroxides from percolating ferruginous water. This weathered appearance helps distinguish field flint from the much fresher-looking Quarry Flint.

Its widespread availability, combined with its hardness and resistance to weathering, means that Quaternary Flint is one of the most dominant types of building stone used in Buckinghamshire. Many walls and buildings (especially churches) throughout the county employ Quaternary Flint in one form or another, and the stone has been used extensively in many towns and villages.

As a walling stone, Quaternary Flint was employed in a wide variety of ways: as nodules or pebbles laid roughly to course, as squared blocks as part of chequerwork, and as knapped, faced, trimmed or cleaved-faced stone in random or decorative arrangements. Nodules were often selected for their shape and size and laid in either a random or coursed manner.

Notable examples of the use of Quaternary Flint include the Holy Trinity Church at Penn Street (with Quaternary Flint nodules laid to course), cottages along Speen Road, Hughenden, and the impressive entrance to Hellfire Caves and Dashwood Mausoleum at West Wycombe. The last makes decorative use of the juxtaposition of alternating knapped and unworked Quaternary Flint nodules.

Figure 50: Holy Trinity Church, Penn Street. Quaternary Flint nodules.

Figure 51: Cottages, Hughenden. Quaternary Flint nodules and Welsh Slate roofs.

Figure 52: Dashwood Mausoleum, West Wycombe. Decorative flintwork.

Figure 53: Dashwood Mausoleum, West Wycombe. Knapped Quarry Flint and Quaternary Flint contrasting with unworked Quaternary Flint nodules.

Figure 54: St Peter's Church, Iver. Quarry Flint with False Puddingstone, glacial pebbles and cobbles and Roman tiles.

Figure 55: St Peter's Church, Iver. Quaternary Flint.

Figure 56: St Peter's Church, Iver. Quarry Flint and Quaternary Flint nodules.

Glacial pebbles and cobbles

Quaternary-aged fluvio-glacial deposits that formed across parts of Buckinghamshire are usually thin (rarely exceeding 5m in thickness) and encompass a diverse range of poorly sorted, relatively soft and unconsolidated sediments. These vary in composition, but sometimes contain harder pebbles and cobbles of flint, chert, chalk, Permo-Triassic quartzitic sandstones, Carboniferous limestones and sandstones, Jurassic limestones, Lower Cretaceous (Greensand) ironstones (carstone) and occasional igneous and metamorphic rocks.

The presence of abandoned pits confirms that these deposits were once widely exploited for constructional materials, mainly on a local farm or village scale. One by-product of this activity was the collection and use of the harder pebbles and cobbles as a convenient source of stone in local buildings.

The presence of these pebbles and cobbles in buildings in Buckinghamshire tends to be sporadic, but good examples can be seen in St Michael and All Angels Church at Stewkley and St Peter's Church at Iver.

Figure 57: St Michael and All Angels Church, Stewkley. Portland Limestone (Buckinghamshire type) and glacial pebbles and cobbles.

Figure 58: St Peter's Church, Iver. Glacial pebbles and cobbles.

4 Examples of Imported Building Stones

Buckinghamshire has a long history of importing stone. Its proximity to the freestone centres of Oxfordshire and the Cotswolds to the west and Northamptonshire, Rutland and Lincolnshire to the north, as well as the ease of transport provided by the Rivers Thames, Thame and Great Ouse, facilitated the importation of building materials. The development of the Grand Junction Canal in 1800 and the construction of an extensive railway network, starting with the opening of the London to Birmingham line in 1838 and culminating with the Great Central line in the early 20th century, enabled further stone importation.

A wide range of stones was used as ornamental dressings to mansions, civic buildings, churches and chapels. The proximity of the south-east and east of the county to London led to the development of large estates and the construction of mansion houses, especially in the southern Chilterns, the Thames Valley and around Aylesbury. Mansions were often constructed using imported stone, including Waddesdon Manor (Bath Stone) and Mentmore (Ancaster Stone).

Between the 1850s and the 1930s, Gothic Revival and Arts and Crafts architects often favoured the use of local and imported stone for churches, houses and cottages. The rapid population growth of the 19th century led to the construction of a comparatively large number of new Anglican and Roman Catholic churches. Although the majority were built mainly of local flint, imported stones, especially Middle Jurassic limestones, were often used for the dressings and steeples. Various other imported stones were used for decorative effect in churches of the Victorian High Gothic, often in conjunction with brick and flint. Imported stone dressings were frequently used in brick buildings of the neo-Georgian movement, particularly in public buildings that were constructed in the county's rapidly expanding towns during the 19th and 20th centuries.

Other types of imported building stones can be found in mid to late 19th and early 20th-century prestigious buildings in the larger towns. These typically include red Permo-Triassic sandstones and pale, yellow-brown, Middle Jurassic oolitic limestones from the Cotswolds, Bath area or Lincolnshire. Particularly distinctive is the white Upper Jurassic Portland Stone from quarries in Dorset.

Sedimentary buildings stones

Upper Carboniferous

Millstone Grit Group

Millstone Grit Sandstone, Derbyshire

Hard, medium to coarse-grained sandstone, sometimes pebbly and feldspathic, with a distinctive granular appearance and occasional flakes of white mica. Millstone Grit Sandstone exists in various colours, ranging from pale grey and pink (especially when fresh) to buff or pale brown (particularly when weathered). It is employed sporadically in Buckinghamshire and is usually associated with industrial or transport infrastructure, such as bridges and walling along canals and railways.

Figure 59: Stony Stratford Bridge over the River Ouse. Ashover Grit (Marsden Formation).

Carboniferous

Pennine Coal Measures Group

York Stone, West/South Yorkshire

Buff to pale grey or greenish-grey, typically fine-grained sandstones, which are often micaceous and laminated, but occasionally show cross-bedding. York Stone usually weathers evenly but may separate along mica-rich horizons. It is mainly employed in Buckinghamshire as flagstones, paving stones or plinths.

Figure 60: Churchyard of St John the Baptist, Little Marlow. York Stone.

Triassic

Sherwood Sandstone Group, Helsby Sandstone Formation

Hollington Stone, Staffordshire

A pale red to red-brown sandstone that often exhibits small-scale cross-bedding and sometimes ripple marks and laminations in many blocks observed in buildings. It is only occasionally employed in Buckinghamshire and has been used mainly for decorative purposes, especially as cornerstones, quoins or window dressings.

Figure 61: Church of St George the Martyr, Wolverton. Blisworth Limestone with Hollington Stone dressings.

Attleborough Sandstone, Warwickshire

A fine to medium-grained, pale greenish-grey or whitish to pale brown sandstone that characteristically exhibits cross-bedding and lamination structures. Attleborough Sandstone is durable and resistant to weathering and its even-grained qualities make it an excellent freestone.

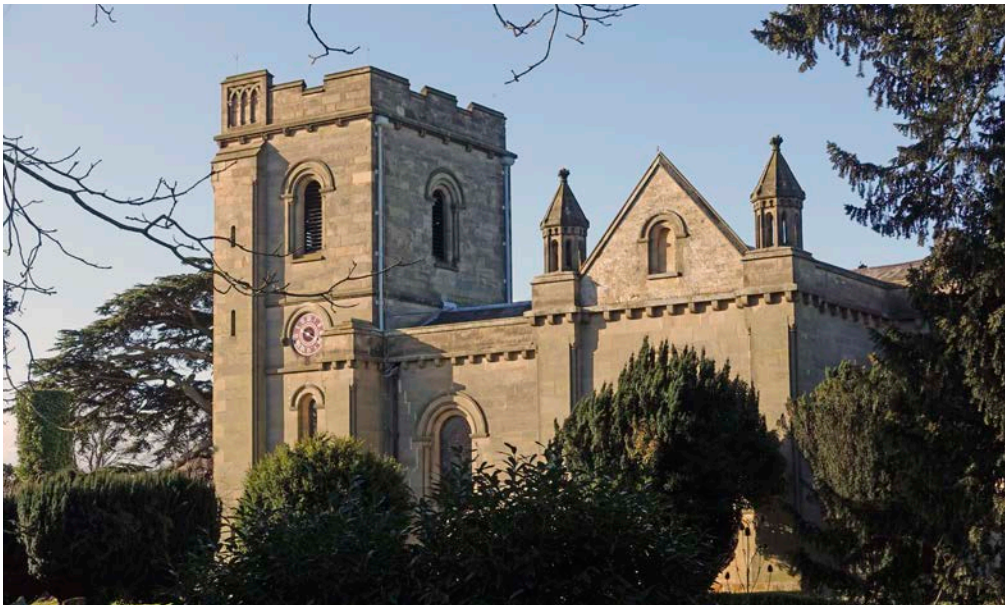


Figure 62: Church of the Holy Trinity, Wolverton. Attleborough Sandstone and Blisworth Limestone.

Lower Jurassic

Lias Group, Bridport Sand Formation

Ham Hill Stone (Ham Stone), Somerset

A medium-grained shelly limestone that is readily sawn and dressed. When freshly cut, the stone has a light, golden yellowish-brown colour, but this darkens with age and weathering. The latter picks out the weaker, less cemented seams and cross-bedding features, which are characteristic of this sandy limestone. Ham Hill Stone is relatively little used in Buckinghamshire, but where it has been recorded the stone is usually employed in only small amounts for decorative work.

Figure 63: The Lodge Cottage, Henley Road, Medmenham. Brick with knapped flint and Ham Hill Stone chequerwork.

Middle Jurassic

Inferior Oolite Group, Northampton Sand Formation

Northampton Ironstone (Northampton Sandstone), Northamptonshire

Orange-brown-coloured ferruginous, ooidal and sandy limestones that are commonly described as ‘ironstones’. Fresh surfaces may appear dark greenish-grey in colour, but they readily weather to a yellow-brown or orangish hue. Although relatively soft and often susceptible to weathering, Northampton Ironstone has been widely but sporadically used as a building stone in Buckinghamshire. Particularly fine examples can be seen in Olney, at the church hall and The Swan Inn along the High Street, and in Hoggeston, at the Church of the Holy Cross.

Figure 64: Church of the Holy Cross, Hoggeston. Northampton Ironstone and Portland Limestone.

Figure 65: Church wall, Hoggeston. Northampton Ironstone.

Inferior Oolite Group, Lincolnshire Limestone Formation

Ancaster Stone, Lincolnshire

A medium to coarse-grained, creamy-white to pale yellow-coloured (although rather ochreous in places) ooidal and bioclastic limestone. Weathered surfaces commonly display a streaky bacon-like patterning. In Buckinghamshire, Ancaster Stone, along with other imported Inferior Oolite limestones, tends to have been used in the construction of prestigious buildings, especially for the dressings of churches or chapels.

Figure 66: Mentmore Towers, near Wingrave. Ancaster Stone.

Ketton Stone, Rutland

A porous, cream to pale yellow-coloured (occasionally pale pink-stained) ooid-rich bioclastic limestone with a well-sorted texture. Ketton Stone lends itself to being quarried in large blocks and is regarded as a high-quality freestone.

Figure 67: Old County Hall and Crown Court, Market Square, Aylesbury. Brick with Ketton Stone.

Weldon Stone, Northamptonshire

Pale cream or grey coloured when fresh, but weathers to shades of yellow and buff. Weldon Stone is an ooidal and bioclastic limestone exhibiting cross-bedding structures. It has been employed for ashlar and decorative work, and despite being quite porous it is remarkably weather resistant.

Figure 68: Entrance gateway, Tyringham Hall, near Newport Pagnell. Roman cement render and Weldon Stone dressings.

Great Oolite Group, Chalfield Oolite Formation

Bath Stone, Bath, NE Somerset and possibly Corsham area, Wiltshire

A cream to buff-coloured, variably bioclastic, ooidal limestone (freestone). Bath Stone is much used throughout Buckinghamshire, especially in Victorian new-build projects and church refurbishments, especially as ashlar and for window and door mouldings. Other similar creamy or pale-coloured oolitic limestones from the Great Oolite Group, such as Cotswolds Limestone, were also occasionally employed in the county. A particularly noteworthy example of Bath Stone can be seen at Waddesdon Manor.

Figure 69: Waddesdon Manor, near Aylesbury. Bath Stone ashlar.

Great Oolite Group, Taynton Limestone Formation

Helmdon Stone, Northamptonshire

A pale yellow-coloured sandy limestone that typically exhibits cross-bedding structures and contains much broken fossil material (including oyster shell debris and sea urchin spines). Helmdon Stone is rarely encountered in Buckinghamshire, but where seen it has been employed as ashlar in prestigious buildings and fine stately homes, including Shalstone House and Stowe House.

Figure 70: Stowe House, Stowe. Helmdon Stone ashlar.

Great Oolite Group, Blisworth Limestone Formation

Blisworth Limestone (Northamptonshire types, including Cosgrove Stone), Northamptonshire

A cream to pinkish coloured, cross-bedded limestone containing granular shell debris and possessing a 'matrix' that varies from soft and powdery to sparry and more resistant.

Figure 71: Milton Keynes Arts Centre, Great Linford. Blisworth Limestone and a pink Northamptonshire type limestone.

Upper Jurassic

Portland Stone Formation, Portland Group

Portland Stone (Dorset type), Isle of Portland, Dorset

A near-white or very pale coloured limestone that (in its basebed guise at least) is typically a fine and even-grained freestone. It has seen widespread use across Buckinghamshire, especially in urban areas in carved form, and has been used for milestones, obelisks, monuments, war memorials, gravestones, fountains and columns. Portland Stone is also employed as a high-quality walling stone and ashlar, often forming the fronts of civic buildings and banks.

Figure 72: Town hall, Queen Victoria Road, High Wycombe. Brick and Portland Stone.

Metamorphic building stones

Roofing slates — Cumberland Green Slate, Westmorland Slate, Welsh slate

Several different types of roofing slates have been imported into and variously used in Buckinghamshire since at least the 19th century. Welsh Slate, for example, was commonly employed in many of the county's villages and towns, including Aylesbury.

Figure 73: Holly Mount, Penn Road, Knotty Green. Bath Stone dressings and Cumberland Green Slate roof.

Figure 74: Hartwell House, near Aylesbury. Westmorland Slate roof.

5 Further Reading

The Further Reading, Online Resources and Contacts guide provides general references on:

- Geology, building stones and mineral planning
- Historic building conservation, architecture and landscape.

There is also a separate glossary of geological terms.

Buckinghamshire references

Casey, R and Bristow, C R 1964 'Notes on some ferruginous strata in Buckinghamshire and Wiltshire', *Geological Magazine*, **101**, 116–28

Davis, R 1983 *The English Rothschilds*. London: Collins

Eyers, J 1998 *Geological Walks in South Buckinghamshire: Rocks Afoot Field Guide Series*

Eyers, J 1999 *Geological Walks in North Buckinghamshire: Rocks Afoot Field Guide Series*

Eyers, J 2007 *Rock around Bucks: Rocks, Fossils and Landscapes*

Morley Davies, A and Baines, A H J 1953 'A preliminary survey of the sarsen and puddingstone blocks of the Chilterns', *Proceedings of the Geologists' Association*, **64** (1), 1–9

Pevsner, N 1960 *The Buildings of England: Buckinghamshire*. London: Penguin Books

Summerfield, M A and Whalley, W B 1980 'Petrographic investigation of sarsens (Cenozoic silcretes) from southern England', *Geologie en Mijnbouw*, **59** (2), 145–53

Whitaker, W 1865 'On the chalk of Buckinghamshire and on the Totternhoe Stone', *Quarterly Journal of the Geological Society of London*, **21**, 398–400

Whitehead, J W R 1967 'Traditional building materials in the Chilterns', *Oxoniensia*, **32**, 1–9

British Geological Survey publications

Aldiss, D T 1990 'Geological notes and local details for the 1:10 000 Sheet SP92SE (Totternhoe)'. British Geological Survey, Technical Report WA/91/51

Barron, A J M *et al* 2010 *Geology of the Bedford district – a brief explanation of the geological map Sheet 203*. British Geological Survey. 38pp.

Benham, A J *et al* 2003 'Mineral resource information in support of national, regional and local planning: Buckinghamshire and Milton Keynes'. British Geological Survey, Commissioned Report CR/03/77N

Dewey, H and Bromehead, C E N 1915 *The Geology of the Country Around Windsor and Chertsey: Explanation of One-inch Geological Sheet 269*. Memoirs of the Geological Survey of Great Britain (England and Wales). London: HMSO

Ellison, R A and Williamson, I T 1999 *Geology of the Windsor and Bracknell District: A Brief Explanation of the Geological Map Sheet 269 Windsor*. Keyworth: British Geological Survey

Green, A H 1864 *The Geology of the Country Round Banbury, Woodstock, Bicester and Buckingham: Sheet 45 of the Map of the Geological Survey of Great Britain*. Memoirs of the Geological Survey of England and Wales. London: HMSO

Horton, A, Shephard-Thorn, E R and Thurrell, R G 1974 'The geology of the new town of Milton Keynes'. Institute of Geological Sciences Report 74/16. London: HMSO

Horton, A, Sumbler, M G, Cox, B M and Ambrose, K 1995 *Geology of the Country Around Thame: Memoir for 1:50 000 Geological Sheet 237*. Memoirs of the Geological Survey of Great Britain (England and Wales). London: HMSO

Jukes-Browne A J and White, H J O 1908 *The Geology of the Country Around Henley-on-Thames and Wallingford: Explanation of One-inch Geological Sheet 254*. Memoirs of the Geological Survey of Great Britain (England and Wales). London: HMSO

Morigi, A N, Woods, M A, Reeves, H J, Smith, N J P and Marks, R J 2005 *Geology of the Beaconsfield District: A Brief Explanation of the Geological Map Sheet 255 Beaconsfield*. Keyworth: British Geological Survey

Shephard-Thorn, E R, Moorlock, B S P, Cox, B M, Allsop, J M and Wood, C J 1994 *Geology of the Country Around Leighton Buzzard: Memoir for 1:50 000 Geological Sheet 220*. Memoirs of the Geological Survey of Great Britain (England and Wales). London: HMSO

Sherlock, R L and Noble, A H 1922 *The Geology of the Country Around Beaconsfield: Explanation of One-inch Geological Sheet 255*. Memoirs of the Geological Survey of Great Britain (England and Wales). London: HMSO

Sumbler, M G 2002 *Geology of the Buckingham District: A Brief Explanation of the Geological Map Sheet 219 Buckingham*. Keyworth: British Geological Survey

6 Contact Historic England

East of England
Brooklands
24 Brooklands Avenue
Cambridge CB2 8BU
Tel: 01223 582749
Email: eastofengland@HistoricEngland.org.uk

Fort Cumberland
Fort Cumberland Road
Portsmouth
Hampshire PO4 9LD
Tel: 023 9285 6700
Email: fort.cumberland@HistoricEngland.org.uk

London and South East
4th Floor
Cannon Bridge House
25 Dowgate Hill
London EC4R 2YA
Tel: 020 7973 3700
Email: londonseast@HistoricEngland.org.uk

Midlands
The Foundry
82 Granville Street
Birmingham B1 2LH
Tel: 0121 625 6888
Email: midlands@HistoricEngland.org.uk

North East and Yorkshire
Bessie Surtees House
41-44 Sandhill
Newcastle Upon
Tyne NE1 3JF
Tel: 0191 269 1255
Email: northeast@HistoricEngland.org.uk

North East and Yorkshire
37 Tanner Row
York YO1 6WP
Tel: 01904 601948
Email: yorkshire@HistoricEngland.org.uk

North West
3rd Floor, Canada House
3 Chepstow Street
Manchester M1 5FW
Tel: 0161 242 1416
Email: northwest@HistoricEngland.org.uk

South West
Fermentation North
(1st Floor)
Finzels Reach
Hawkins Lane
Bristol BS1 6JQ
Tel: 0117 975 1308
Email: southwest@HistoricEngland.org.uk

Swindon
The Engine House
Fire Fly Avenue
Swindon SN2 2EH
Tel: 01793 445050
Email: swindon@HistoricEngland.org.uk

7 Acknowledgements

The Building Stones of England series was developed by Geckoella Ltd (Andy King), the British Geological Survey (Don Cameron, Graham Lott, and Stephen Parry), and Historic England (Clara Willett).

Historic England and the British Geological Survey developed the Building Stones Database for England with advice from many local geologists and historic building experts and all these individuals are thanked for their contributions.

For this guide, Historic England would like to also thank Bucks Geology Group, Danesfield House and Hartwell Park, and Nicola Lauder and Chris Welch (Historic England).

The Department for Levelling Up, Housing and Communities supported the development of the Building Stones of England database project.

Figures

Historic England

We are the public body that helps people care for, enjoy and celebrate England's spectacular historic environment.

Please contact NationalSpecialistServices@HistoricEngland.org.uk with any questions about this document.

HistoricEngland.org.uk

If you would like this document in a different format, please contact our customer services department on:
Tel: 0370 333 0607
Email: customers@HistoricEngland.org.uk

All information and weblinks accurate at the time of publication.
Please consider the environment before printing this document.

Product code: HEBSE04
Publication date: August 2018
Reissue date: May 2023
Design: Historic England