Historic England

Wiltshire

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 is based on original research and text by Isobel Geddes.

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Front cover: High Street, Old Town, Swindon. Swindon Stone and Bath Stone. © Greg Balfour Evans / 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 planning authority areas of Wiltshire County Council and Swindon Borough Council.

Contents

1 Introduction 1

2 Local Building Stones 5

Blue Lias, Ham Hill Stone 5
Doulting Stone 6
Bath Stone (Bath Oolite, Combe Down Oolite (Box Ground)) 6
Ragstone 9
Ancliff Oolite 10
Cornbrash 11
Kellaways Rock 11
Coral Rag, Calne Stone, Corallian limestones 11
Chilmark Stone (Tisbury Stone, Swindon Stone) 12
Purbeck Stone 13
Lower Greensand Stone 14
Hurdcott Stone, Upper Greensand Stone 14
Flint 15
Chalk (Clunch) 16
Sarsen Stone 18

3 Further Reading 19

4 Contact Historic England 21

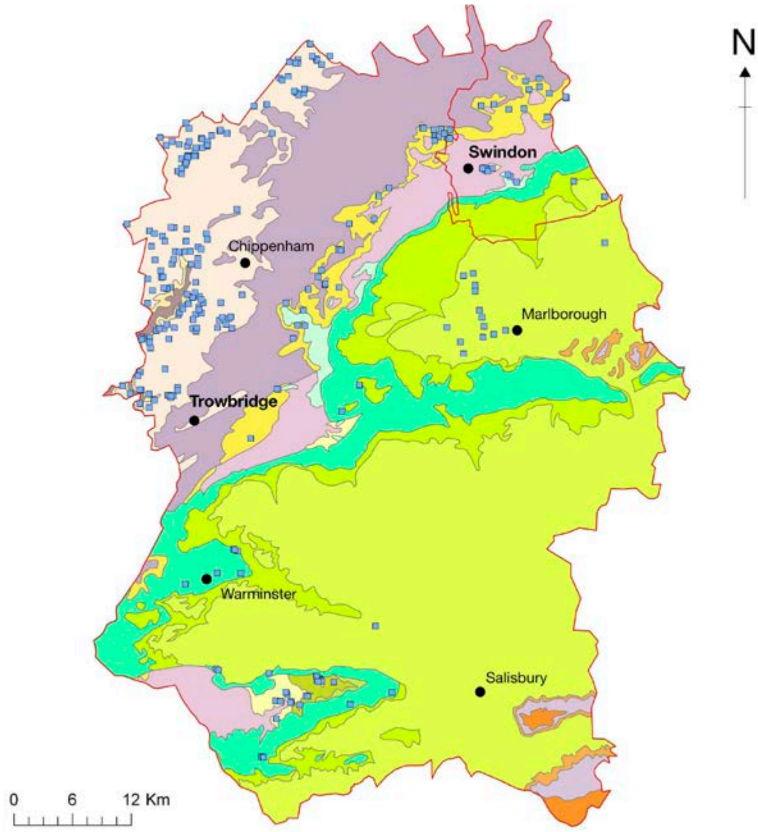
5 Acknowledgements 22

1 Introduction

The character of a region is largely determined by its landscape and the local stones used to build its towns and villages. Generally, it is the harder limestones and sandstones that are used for building. The properties of the stone, colour, texture, bed thickness, durability, lateral extent and currently available technology for extraction and preparation, all determine which stones are used where. Transport has always been a major consideration because of the sheer weight and bulk of building stones. The advent of some 29 river navigation improvements during the 16th and 17th centuries, and the development of the railways in the 19th century and subsequently roads, opened the way for more widespread transport of stone far from its source of origin. The local character of towns and villages has changed as non-local building materials were brought in and the old sources neglected. The use of local building stone has significantly declined in Wiltshire in the past 100 years, mainly due to the easy availability of cheaper alternative building materials.

Figure 1: Castle Combe village. Local Jurassic limestone.

Bedrock Geology Map



Key

- Building stone sources

Bedrock geology

- Bracklesham Group and Barton Group — sand, silt and clay
- Thames Group — clay, silt, sand and gravel
- Lambeth Group — clay, silt, sand and gravel
- White Chalk Subgroup — chalk
- Grey Chalk Subgroup — chalk
- Gault Formation and Upper Greensand Formation — mudstone, sandstone and limestone
- Lower Greensand Group — sandstone and mudstone
- Wealden Group — sandstone and siltstone, interbedded
- Purbeck Limestone Group — limestone and mudstone, interbedded
- Portland Group — limestone and calcareous sandstone
- Corallian Group — limestone, sandstone, siltstone and mudstone
- West Walton Formation, Ampthill Clay Formation and Kimmeridge Clay Formation — mudstone, siltstone and sandstone
- Kellaways Formation and Oxford Clay Formation — mudstone, siltstone and sandstone
- Great Oolite Group — sandstone, limestone and argillaceous rocks
- Inferior Oolite Group — limestone, sandstone, siltstone and mudstone
- Lias Group — mudstone, siltstone, limestone and sandstone

Derived from BGS digital geological mapping at 1:625,000 scale, British Geological Survey

Stratigraphic Table

Geological timescale	Groups		Formations	Building stones	Page
Tertiary	Barton Group		Barton Clay Formation		
	Bracklesham Group		Selsey Sand Formation	Sarsen Stone	18
			Marsh Farm Formation		
			Wittering Formation		
	Thames Group		London Clay Formation		
	Lambeth Group		Reading Formation		
Upper Cretaceous	Chalk Group	White Chalk Subgroup	Portsdown Chalk Formation	Chalk (Clunch) Flint	16 15
			Culver Chalk Formation		
			Newhaven Chalk Formation		
			Seaford Chalk Formation		
			Lewes Nodular Chalk Formation		
			New Pit Chalk Formation		
			Holywell Nodular Chalk Formation		
		Grey Chalk Subgroup	Zig Zag Chalk Formation		
			West Melbury Marly Chalk Formation		
Lower Cretaceous	Selborne Group		Upper Greensand Formation	Hurdcott Stone, Upper Greensand Stone	14
			Gault Formation		
	Lower Greensand Group		various	Lower Greensand Stone	14
	Wealden Group		various		
	Purbeck Group		various	Purbeck Stone	13

Geological timescale	Groups	Formations	Building stones	Page
Upper Jurassic	Portland Group	Portland Stone Formation	Chilmark Stone (Tisbury Stone, Swindon Stone)	12
		Wardour Formation		
	Ancholme Group (part)	Kimmeridge Clay and Ampthill Clay formations		
	Corallian Group	various	Coral Rag, Calne Stone, Corallian limestones	11
	Ancholme Group (part)	West Walton and Oxford Clay formations		
Middle Jurassic		Kellaways Formation	Kellaways Rock	11
	Great Oolite Group	Cornbrash Formation	Cornbrash	11
		Forest Marble Formation	Ancliff Oolite Ragstone	10 9
		Chalfield Oolite Formation	Bath Stone (Bath Oolite, Combe Down Oolite (Box Ground))	6
		Sharp's Hill Formation		
		Fuller's Earth Formation		
	Inferior Oolite Group	various	Doulting Stone	6
Lower Jurassic	Lias Group	Bridport Sand Formation	Ham Hill Stone	5
		Blue Lias Formation, Charmouth Mudstone Formation	Blue Lias	5

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

2 Local Building Stones

Jurassic

Jurassic limestones have provided the best stone for building in Wiltshire.

Lower Jurassic

Lias Group, Blue Lias Formation, Bridport Sand Formation, Charmouth Mudstone Formation

Blue Lias, Ham Hill Stone

The rocks of the Lias Group crop out in the valleys of west Wiltshire, but they were not used for building purposes in this small area. However, outcrops of the group are more extensive south-west of the county boundary, in Gloucestershire and Somerset, and building stones from this area have been imported and used to some extent in Wiltshire.

The Blue Lias Formation occurs in the lowest part of the Lias Group and it consists of interbedded limestones and fissile mudstones. The hard, fine-grained, muddy limestone beds are only up to 0.3m thick. Blue-grey when fresh, they weather rather patchily to shades of pale yellow-brown. The stone was used extensively in buildings near its outcrop, and more widely as paving stones. In the 12th and 13th centuries, it was used for polished shafts as an inferior substitute for Purbeck Marble.

Ham Hill Stone is a coarsely shelly limestone facies of the Upper Lias west of Yeovil in Somerset, capping the isolated plateau of Ham Hill and nearby hills to the south. The upper 4 to 15m are durable, high-quality freestone, composed of well-sorted shell fragments, with a distinctive golden-brown colour and strong cross-bedding, often accentuated by weathering. It has been used since Roman times and can be found in buildings over a wide area, often as dressings in association with other materials.

Middle Jurassic

Inferior Oolite Group, various formations

Doulting Stone

Although shelly, ooidal limestones from the Inferior Oolite Group crop out along the river valleys of western Wiltshire, Doulting Stone is the most important building stone from the group that is used in the county. It is still quarried east of Shepton Mallet in Somerset. Doulting Stone has been widely used, particularly in the 19th and 20th centuries, beyond the boundaries of Somerset.

The freestone beds are 8 to 9m thick and they are readily distinguished by their cross-bedding and coarsely granular texture, formed from the broken-up remains of fossil crinoids (sea lilies) cemented by spar calcite. The stone tends to weather grey, but it is yellowish-white to creamy-brown when fresh. It was much used for ashlar and dressings.

Great Oolite Group

The Great Oolite Group in Wiltshire includes several limestone units that have yielded durable building stones: the Chalfield Oolite Formation, Corsham Limestone Formation, Forest Marble Formation and Cornbrash Formation. The Cornbrash Formation is at the top of this group, while at the base is the Fuller's Earth, a mainly clay-rich formation. The Chalfield Oolite and the Forest Marble formations are the most important units of the group for building stones in Wiltshire.

Great Oolite Group, Chalfield Oolite Formation

Bath Stone (Bath Oolite, Combe Down Oolite (Box Ground))

This formation includes the nationally renowned Bath Stone. It is up to 30m thick but is only present north of Norton St Philip (Somerset). The Bath stones form part of the Cotswold Stone belt, which crosses north-western Wiltshire, from Farleigh Hungerford in Somerset to Malmesbury. Freestones, ragstones and tile stones have been widely used in the Cotswold region for both buildings and drystone walls. The older parts of the towns and villages of north-west Wiltshire all have buildings made of these Jurassic limestones. They were used extensively, even in the clay vales to the east, for example at Lacock.

The Bath Stone ooidal and shelly limestones are virtually free of large fossils, so they can be cut in any direction without splitting, hence the name 'freestone'. They comprise three distinct geological units: the lowest is the Combe Down Oolite; the Bath Oolite lies above, usually separated by ragstone; and the highest freestone is the Ancliff Oolite, nowadays placed in the overlying Forest Marble Formation. These massive limestone beds have been utilised for building since Roman times, some 2,000 years ago, when

Figure 2: Castle Combe. Bath Stone and limestone roof tiles.

they were used extensively in Bath. During the Anglo-Saxon period, Bath Stone was employed over a surprisingly large area, at the 7th-century St Laurence Church in Bradford on Avon, for example, continuing through the Middle Ages at Malmesbury Abbey, Lacock Abbey, Monkton Farleigh Priory, Great Chalfield Manor and Longleat House.

However, the golden age of Bath Stone was the 18th century, when it was used in the building of the city of Bath as a fashionable resort. The stone was originally cut from surface quarries, but, as the best quality beds are usually only a few metres thick, it soon became necessary to follow them into the hillsides. Vast underground mine workings developed. Along the route of the Kennet and Avon Canal, steep tramways linked the quarries high on the Avon Valley sides with the canal at Avoncliff, Murhill and Conkwell. Murhill Quarry opened in 1803 to supply stone for constructing the Kennet and Avon Canal. It was not an ideal choice, because the limestone could not withstand the constant dampness from the leakage of water from the canal, exemplified by

Figure 3: Lacock Abbey, Lacock. Bath Stone.

the crumbling face of the Avoncliff Aqueduct, now repaired. The quality of the limestones varies greatly, and the differences in durability are related to the porosity, fossil content, thickness of beds and stratigraphic level in the formation. The more durable varieties are known as groundstones (forming the lower 3.6m of the freestone at the Box quarries, for example).

Figure 4: Avoncliff Aqueduct. Bath Stone.

The strength of Bath Stone comes from the crystalline (spar) calcite cement between the grains, rather than from the ooids. The cement prevents water being absorbed into the rock by the softer porous ooids. This cement is, in part, derived from carbonate leached from shell fragments mixed in with the ooids, which recrystallised after burial. Thus, it is no coincidence that the best weatherstone in the area, Box Ground (Combe Down Oolite), contains the highest proportion of shell debris. The same level was extensively worked in the hills around Bath, and it is still quarried there on Combe Down. It was probably these lower beds of the formation that gave Bath Stone its reputation.

Two articles in *The Builder* of 1895 describe in some detail 47 working Bath Stone quarries in the Bath/Bradford on Avon/Corsham area. Of these, the higher and softer level of the freestone (Bath Oolite) is still worked underground at Westwood (Westwood Ground), Limpley Stoke (Stoke Ground), Hartham Park and Monks Park near Corsham, and Elm Park to the south. The Bath Oolite here is up to 13m thick and there is enough shell debris and crystalline cement between the ooids to produce good building stone.

The Westwood mines were opened originally as a source of stone to build the railway, and it was the building of the Great Western Railway's Box Tunnel that revealed more valuable high-quality stone running in the direction of Corsham. This discovery led to the development of the vast underground workings in this area below the Forest Marble Formation, which continue to the present day. By 1900, there was a network of tunnels and tramways for the removal of stone, totalling around 95km in length.

Any irregularities or cracks ruin the stone for top quality building, thereby reducing its value. The stone is soft and easy to work when first quarried. It is traditionally kept underground until May, because the freshly quarried stone can be damaged by frost (due to its high water content). It is then seasoned on the surface through the summer, where it dries out naturally. However, the huge demand for stone in the 19th century often resulted in unseasoned stone being used, with disastrous consequences. The stones must also be kept the right way up when building, with the bedding planes horizontal, otherwise fine layers will tend to flake off from the surface because weathering will pick out any weaknesses in the bedding.

Figure 5: Library, Bradford on Avon. Bath Oolite.

Great Oolite Group, Forest Marble Formation

This formation comprises a varied sequence of limestones, sands and clays. The name derives from the ancient forest of Wychwood in Oxfordshire, where a harder limestone that could be polished was formerly quarried.

Ragstone

In the Forest Marble Formation, generally, the bedding is more irregular and there are clays separating the limestones. The limestones, known as ragstone, are typically yellow-brown with a blue ‘heart’. They are made up of broken shell debris and are less thickly bedded than the ooidal limestones. Cross-bedding is typical and the matrix is crystalline calcite. This makes the limestones a good weatherstone, but they are too intractable to be used for dressings.

They have been employed extensively for cottages, farm buildings and as a walling stone. Thinly bedded, fissile, shelly limestones provided the stone roof slates typical of the older Cotswold buildings, as well as cobbles and larger paving slabs. Small pits in fields around Bradford on Avon, Atworth, Gastard and Malmesbury were excavated for this purpose.

Figure 6: Garden building. Fissile ragstone roof slates.

Ancliff Oolite

The freestone from the Bradford on Avon area, the Ancliff Oolite, occurs locally in the lower part of the Forest Marble. It is quite distinctive, characterised by strongly developed cross-bedding, with layers of well-sorted shell fragments that are picked out by weathering. It was widely used from the 18th to the 20th century in Bradford and Trowbridge, but it is no longer worked. Hall’s Almshouses in Bradford on Avon are constructed of Ancliff Oolite.

Figure 7: Hall's Almshouses, Bradford on Avon. Ancliff Oolite.

Great Oolite Group, Cornbrash Formation

Cornbrash

This is the uppermost formation of the Great Oolite Group. It weathers to a rich brown colour and is a shelly ragstone used mainly for walling along the outcrop.

Ancholme Group, Kellaways Formation

Kellaways Rock

This is the lowest unit found in the Avon and Thames Valleys, which separate the Wiltshire Cotswold region from the chalk downlands. It contains a local building stone horizon at the top, known as the Kellaways Rock, which crops out north-east of Chippenham, around the village of Kellaways. Here, the hard calcareous sandstone, up to 4m in thickness, has been used to build Maud Heath's Causeway, a 15th-century footbridge over the floodplain.

Figure 8: Maud Heath's Causeway. Kellaways Rock.

Upper Jurassic

Corallian Group, various formations

Coral Rag, Calne Stone, Corallian limestones

This group includes many different rock types used locally for building: sandstones, sandy limestones and shelly limestones, often with peloids or ooids, and coral fragments. They are generally not very regularly bedded, but they do provide durable building stones.

The white Calne Stone is a cross-bedded peloidal limestone with small shell fragments. It was quarried around Lyneham and Calne.

Freestones are exceptional in this group, however, and the Corallian limestone areas typically show a variety of hardstone blocks and rubblestone in the buildings. The wide variety of textures and tones of cream, grey and brown imparts a particular charm to the villages and towns along its outcrop, including at Highworth and Wootton Bassett. Dressings are often of local brick or freestone, as can be seen at Highworth. The Coral Rag Formation is a fine-grained, coralline, rubbly limestone, formed around the reefs as detrital build-ups. It can make good quality, durable, building stone.

Figure 9: High Street, Highworth. Calne Stone.

Portland Group, Portland Stone Formation

Chilmark Stone (Tisbury Stone, Swindon Stone)

In Wiltshire, beds of the Portland Group outcrop beneath the Cretaceous rocks in the Vale of Wardour and at Swindon. The succession contains both sandstones and limestones. In the Vale of Wardour, the upper part of the group, known as the Portland Stone Formation, has been quarried extensively for building during and since medieval times. It is generally known as Chilmark Stone, although the main outcrop is around Tisbury, where it is known as Tisbury Stone. The beds vary from highly calcareous, greenish-grey sandstone to pale cream sandy limestone, all with a variable speckling of glauconite grains (a dark green iron silicate mineral). The beds are up to 20m thick and they are still worked for building stone at Chicksgrove Quarry and in a small valley south-east of Chilmark. Here, a stratigraphically higher ooidal freestone has been exploited in the past. It is more than 5m thick, with less sand and no glauconite. Together, these stones give a distinctive character to the local villages.

In Victorian times, the architect Giles Gilbert Scott specified these stones for cathedral and church restorations across south-east England. The stones were also used extensively in Salisbury Cathedral. These freestones are quite different in character to the white ooidal Portland Stone of the same geological age quarried on the Isle of Portland. The hill at Old Swindon contains several old quarries, from which much of the hard calcareous sandstone (Swindon Stone) used to build the Old Town (with dressings of Bath Stone) was worked.

Figure 10: Salisbury Cathedral. Chilmark Stone.

Figure 11: Underground quarry, Chilmark. Chilmark Stone.

Lower Cretaceous

Purbeck Group, various formations

Purbeck Stone

In Wiltshire, the Purbeck beds contain white, fine-grained limestones, also used for building locally. Some beds were sufficiently fissile for roofing. Limestones of this age have been utilised only in the Vale of Wardour and at Swindon. Elsewhere, they are absent, subsequently removed by erosion in Lower Cretaceous times.

Lower Greensand Group, various formations

Lower Greensand Stone

The Lower Greensand stone has only been used locally as a building stone, where natural cementation by iron oxide has rendered it sufficiently durable. The area around Sandy Lane, south-west of Calne, had quarries that provided the dark orange-brown sandstone for the cottages in the village.

Figure 12: Thatched cottages, Sandy Lane. Lower Greensand Stone.

Selborne Group, Upper Greensand Formation

Hurdcott Stone, Upper Greensand Stone

The Upper Greensand stone is recognisable by the abundance of small dark green grains of glauconite in the sandstone, which give it a distinctive greenish-grey colour. Commonly, there is a scattering of shells and fossil burrows throughout its fabric.

Hurdcott Stone is still quarried near Barford St Martin, 9.5km east of Tisbury, where it is used particularly for restoration work. The Upper Greensand stone is generally only hard enough for building purposes in the south of the county, where it is cemented by calcite and silica. It has been widely used for building in Mere and around Shaftesbury. Norman churches in south Wiltshire contain Upper Greensand stone. The upper part of the formation contains nodular chert beds, and these have been used locally for building, at Stourhead, for example. Further north, buildings of Upper Greensand stoneare not common, with the exception of the Potterne Rock: a fine-grained calcareous sandstone used locally at Potterne and in the Vale of Pewsey. The stone was found to make a good damp course, transmitting less moisture from the ground than brick. Consequently, it was commonly used for house foundations and is often seen in the plinths of brick and timber buildings.

Figure 13: Old Ship Hotel, Mere. Upper Greensand Stone.

Figure 14: Rock arch, Stourton. Chert.

Upper Cretaceous

Chalk Group, various formations

Flint

Flints are particularly common as siliceous nodules or bands in the Upper Chalk and they are virtually indestructible. They are resistant to weathering and can thus be used in walls as a protective outer layer. Flints can be used in their original nodular form, to give a wall a rough appearance, or can be split or knapped to give a smoother, glassy surface on the outward-facing side. In skilful hands, the flints can be knapped into rectangular blocks with a flat face, which can be laid in courses like bricks to produce a neat wall. However, the shiny impervious surfaces of fully knapped flints do not bond as well with mortar as flints that have their porous white outer layer still intact. Stone or brick courses were often incorporated in a flint wall to give it extra strength. Limestone was used for carved window dressings, doorways, quoins and buttresses. Decorative effects were achieved by alternating flint with bricks or stone. This can be seen throughout eastern and southern Wiltshire, where a chequered pattern of flint and stone, characteristic of the chalk country, has been produced. Dressings are brick or limestone. This use of flint with limestone characterises the majority of church buildings in the chalk downlands.

Figure 15: St Peter's Church, Milton Lilbourne. Flint and stone; Jurassic limestone tower.

Chalk (Clunch)

This group has the most extensive outcrop in the county, and the stone is known as clunch. In former times, it was pressed into service out of necessity, even though it is not generally considered a satisfactory building stone. It is normally too soft, and even the hard nodular ‘rock’ bands, such as the Melbourn Rock and the Chalk Rock, have variable weathering properties. Despite this, both have been used in the past in buildings. It was usually necessary to have quoins of a harder stone or brick. Around windows and doors, wooden beams, limestone dressings or brick dressings provided extra support. Chalk can be porous and weather badly. It was essential, therefore, to have ‘good shoes and a hat’ to keep a wall dry, reducing the absorption of water and thus preventing flaking or freezing in the winter. A foundation of less porous material (brick or stone) was required, with a protective cover of brick, tile or thatch. Chalk is found occasionally in walls, as rubbly infill panels in old cottages, and on the internal walls of some churches, including St Michael’s Church at Aldbourne, for example.

Figure 16: House, Compton Bassett. Clunch.

Figure 17: Barn, Wiltshire. Clunch and flints.

Tertiary

In the east and south-east borders of the county, preserved above the chalk, are the sands and clays of the Lambeth, Thames and Bracklesham groups, laid down in the succeeding Tertiary period. Most of these beds are unconsolidated, with the exception of ferruginous sandstones in the Bracklesham Group and the well-known Sarsen stones.

Bracklesham Group, Wittering Formation, Marsh Farm Formation, Selsey Sand Formation

Sarsen Stone

Locally, the coarse pebbly sands in the Bracklesham Group of south-east Wiltshire have been cemented by iron oxides to produce a red pebbly sandstone. This ferruginous sandstone can be seen in the older buildings around Downton.

Sarsen stones, found today scattered over the Marlborough Downs, have been used for building locally since prehistoric times, when they were employed for the standing stone circles of Avebury and Stonehenge. At one time, they were probably more widespread in their distribution, but over the years they have been cut up and incorporated into buildings and walls. Romano-British foundations often contain them, and they have been used as tramway setts and kerb stones.

The pervasive silica cementation of Sarsen stone means that they have an unfortunate habit of 'sweating' in damp weather, by condensing atmospheric water vapour onto their surfaces when there are rapid temperature changes. As a particularly dense and hard rock, Sarsen stone is difficult to cut. Medieval builders split the stones by lighting a fire to heat them, then rapidly cooling them by pouring on cold water. By Victorian times, power tools allowed accurate cutting techniques to be employed. As a result of the intractable nature of Sarsen stone, dressings are of brick or imported freestone.

The building of the Kennet and Avon Canal enabled the stones to be carried further afield. Marlborough and the villages of the Kennet Valley are where Sarsen stones have been most widely used in the buildings, which is a reflection of their former abundance in this area.

Figure 18: Building and garden walls, East Kennet. Sarsen stone.

3 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.

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Figures

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