Historic England

Leicestershire

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 Albert Horton and Julie Harrold.

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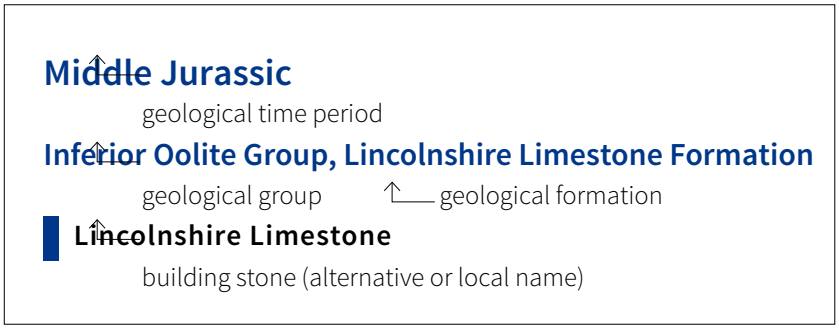
Front cover: Stoneywell, Ulverscroft. Charnwood Diortite. © Joe Giddens / Alamy Stock Photo.

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.



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 authority areas of Leicestershire and the City of Leicester, and the local planning authority areas of North West Leicestershire, Charnwood, Melton, Harborough, Oadby and Wigston, Blaby, Hinckley and Bosworth, and the unitary authority area of the City of Leicester.

Contents

1 Introduction

Leicestershire contains a wide range of distinctive building stone lithologies, and their areas of use show a close spatial link to the underlying bedrock geology.

Charnwood Forest, located to the north-west of Leicester, includes the county's most dramatic scenery, with its rugged tors, steep-sided valleys and scattered woodlands. The landscape is formed principally of ancient volcanic rocks, which include some of the oldest rocks found in England. To the west, rocks of the Pennine Coal Measures crop out around Ashby de la Zouch, representing the eastern edge of the Leicestershire and South Derbyshire Coalfield. To the north-west lie the isolated outcrops of Breedon on the Hill and Castle Donington, which are formed, respectively, of Carboniferous limestone and Triassic (Bromsgrove) sandstone. South of Charnwood Forest, to the west of a line running from Leicester to Lutterworth, the rocks that give rise to the gently undulating landscape are almost all of Triassic age, and they comprise sandstones and red mudstones deposited in fluvial and semi-arid desert environments. To the east, meanwhile, marine sedimentary rocks of Jurassic age crop out, the erosion of which has formed ridge and vale scenery, with limestones and ironstones capping the hills and softer mudstones cropping out in the valley floors.

Around 2 million years ago, modern-day Leicestershire lay within the drainage basin of a major river system, the Bytham River, which flowed eastwards to Norfolk and out into the present North Sea area. Later glaciers advanced and retreated over the whole county, depositing sands and gravels, laminated clays and unsorted till, forming a blanket over the older rocks. New river channels later cut through these unconsolidated glacial deposits, locally exposing the older harder rocks and ultimately giving rise to the distinct topographic features we see today.

As noted at the outset, there is a close relationship between the local geology and the selection of building materials. Generally historically, stone has been used close to its source. This is particularly true for the less common stone types. In some parts of the county that show considerable geological variability, especially around Charnwood Forest and in the north-west, a wide range of lithologies may be found in a single building. Even the cobbles strewn across the land by the pastrivers and glaciers have been used occasionally as wall facings and for paving, and frequently for infill and repair work.

Figure 1: Church of St Peter, Allexton. Northampton Sand, Lincolnshire Limestone dressings and Millstone Grit repairs.

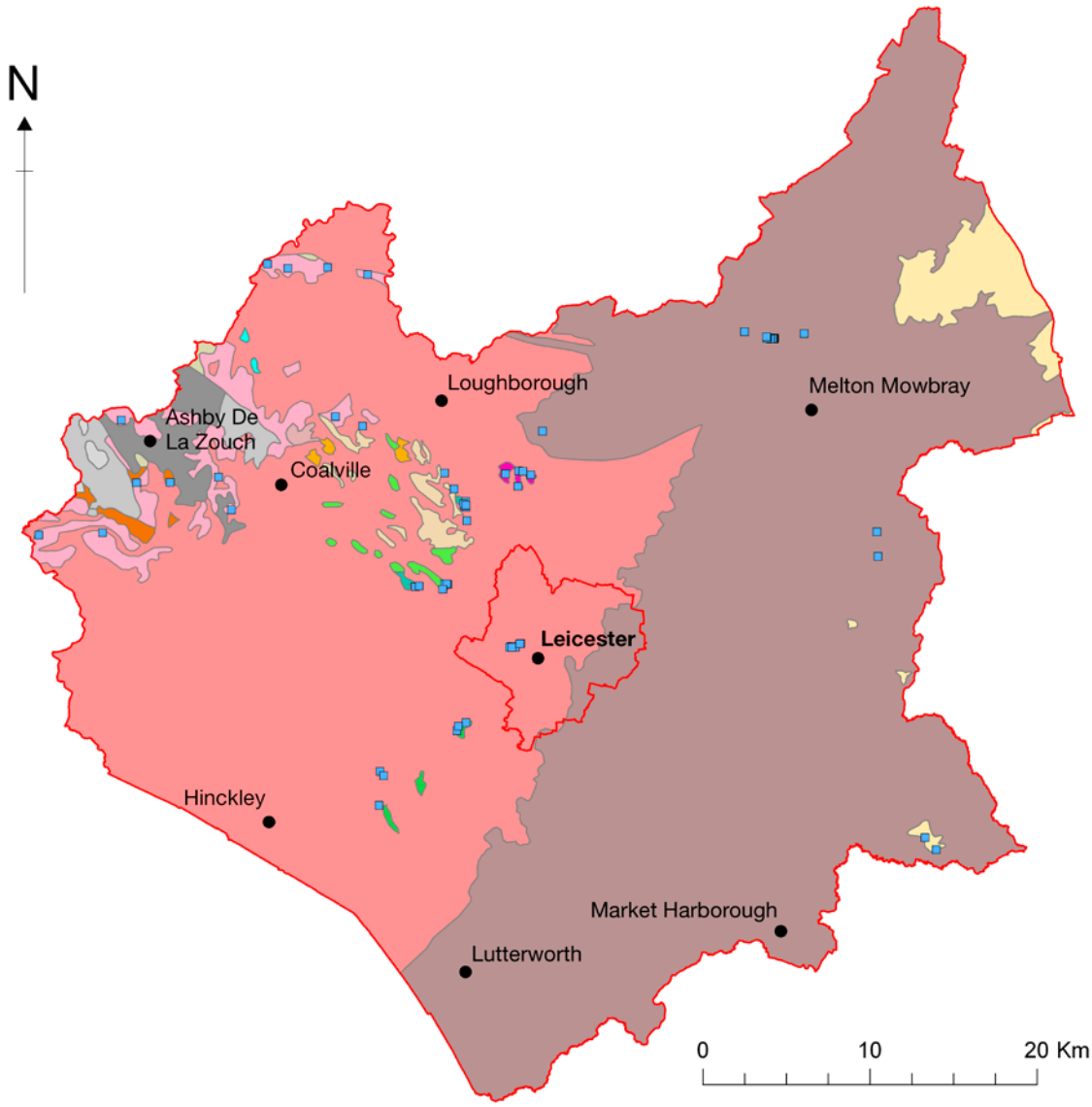
Leicestershire has few freestones, and it has always relied on the importation of such stone from adjacent counties, notably for constructing its more prestigious buildings. Major freestone quarries are found in neighbouring Derbyshire (working Millstone Grit), Rutland and Lincolnshire (both working Lincolnshire Limestone), and Northamptonshire (working Northampton Sand). Triassic Bromsgrove Sandstone was worked extensively in some northern and western parts of the county, but additional stone may have come from Warwickshire and Staffordshire. The only other freestone occurs in the east: the ochreous-brown ironstones of the Middle Lias (mid to upper Lower Jurassic) are used in abundance in local vernacular architecture.

There are no active building stone quarries in Leicestershire, and it has never been a net exporter of building stone. The county's hard igneous rocks are a noteworthy exception, however, and these have been supplied mainly for kerb stones and paving setts, and occasionally for building stone, from the early 19th century. Four quarries continue to supply aggregate, and one of them (Buddon Wood Quarry) still provides small quantities for building and decorative use.

The diversity of Leicestershire's building stone heritage is reflected in its Roman architecture. Leicester was an important Roman town, and it has one of the finest surviving Roman structures in the UK: the Jewry Wall. Decoratively built of courses of thin, locally made, Roman clay bricks and at least eight types of locally sourced rubblestone, it is an architectural catalogue of the local stone resources.

Figure 2: Farm buildings, Wartnaby. Sandrock.

Bedrock Geology Map



Key

Building stone sources

Bedrock geology

Inferior Oolite Group — limestone, sandstone, siltstone and mudstone

Lias Group — mudstone, siltstone, limestone and sandstone

Triassic Rocks (undifferentiated) — mudstone, siltstone and sandstone

Triassic Rocks (undifferentiated) — sandstone and conglomerate, interbedded

Permian Rocks (undifferentiated) — sandstone and conglomerate, interbedded

Pennine Upper Coal Measures Formation — mudstone, siltstone, sandstone, coal, ironstone and ferricrete

Pennine Middle Coal Measures Formation and South Wales Middle Coal Measures Formation (undifferentiated)

Pennine Lower Coal Measures Formation and South Wales Lower Coal Measures Formation (undifferentiated)

Millstone Grit Group — mudstone, siltstone and sandstone

Dinantian Rocks (undifferentiated) — limestone with subordinate sandstone and argillaceous rocks

Unnamed igneous intrusion, Ordovician to Silurian — felsic rock

Unnamed igneous intrusion, Ordovician to Silurian — mafic igneous rock

Lower Cambrian Rocks (undifferentiated) — mudstone, siltstone and sandstone

Unnamed extrusive rocks, Neoproterozoic — felsic tuff

Unnamed extrusive rocks, Neoproterozoic — lava and tuff

Unnamed igneous intrusion, Neoproterozoic — mafic igneous rock

Unnamed metasedimentary rocks, Neoproterozoic — mudstone, sandstone and conglomerate

Stratigraphic Table

Geological timescale	Group	Formation	Building stone	Page
Various	various	various	Pebbles and cobbles	42
Quaternary	various	various	Tufa	41
Middle Jurassic	Inferior Oolite Group	Lincolnshire Limestone Formation	Upper Lincolnshire Limestone (Ketton Stone) Waltham Stone Nevill Holt Stone Collyweston Stone slate	40 40 40 39
		Northampton Sand Formation	Northampton Sand (and varieties)	36
Lower Jurassic	Lias Group	Marlstone Rock Formation	Marlstone Rock (and varieties)	35
		Dyrham Formation	Sandrock	32
		Scunthorpe Mudstone Formation	Sileby Limestone (Fen Farm Limestone) Wreake Limestone	31 31
		Blue Lias Formation	Blue Lias	30
Triassic	Penarth Group	Lilstock Formation	White Lias	30
	Mercia Mudstone Group	Arden Sandstone Formation	Holygate Sandstone, Upper Keuper Sandstone, New Parks Stone, Dane Hills Sandstone	28
		Gunthorpe Formation	Diseworth Sandstone Skerry Sandstones Osgathorpe Conglomerate	28 27 27
	Sherwood Sandstone Group	Bromsgrove Sandstone Formation	Shepshed Sandstone, Pebbly sandstones Bromsgrove Sandstone, King's Mill Stone, Kegworth Stone	26 24
		Kidderminster Formation	Kidderminster Sandstone (Bunter Pebble Beds)	24
Carboniferous	Millstone Grit Group	Morridge Formation	Morridge Formation Sandstone, Millstone Grit Sandstone	22
	Peak Limestone Group	Cloud Hill Dolostone Formation	Osgathorpe Dolomite	22
		Ticknall Limestone Formation	Grace Dieu Stone	21
		Milldale Limestone Formation	Breedon Stone	20
Ordovician	Mountsorrel Complex. South Leicestershire Diorite Complex		South Leicestershire Diorite Mountsorrel Granodiorite (Mountsorrel Granite)	18 18
Cambrian	Brand Group	Swithland Formation	Swithland Slate	16
		Brand Hills Formation	Stable Pit Quartzite	15
Precambrian — Neoproterozoic (Charnian)	South Charnwood Diorites		South Charnwood Diorite (Markfieldite, Groby Granite)	12
	North Charnwood Diorites		North Charnwood Diorite	12
	Blackbrook Group, Maplewell Group	Charnwood Lodge Volcanic Formation	Charnian banded tuffs St Bernard Tuff	12 11
		not assigned	Charnian crystal tuffs Charnian volcaniclastic breccias Charnian volcaniclastic sandstone	11 11 10
	Whitwick Volcanic Complex		Sharpley Porphyritic Dacite Peldar Dacite Breccia Grimley Andesite	9 8 8
	Bardon Hill Volcanic Complex		Bardon Breccia	7

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

2 Local Building Stones

Precambrian

The volcanoes that formed the rocks of Charnwood Forest are thought to have had their magmatic centre close to the present-day Bardon Hill in the west of the forest. There are two associated volcanic complexes, each now the site of a large quarry, at Bardon and Whitwick. The lavas are of andesitic or dacitic composition, and they have been quarried primarily to supply aggregate to the south and east of England. This practice has been going on for well over a century, but the rocks have been used locally as a building stone (albeit to a limited extent) for far longer.

Bardon Hill Volcanic Complex

Bardon Breccia

This is best observed in the ornate 19th-century St Peter's Church at Bardon, where it has been used as an angular rubblestone (with Lincolnshire Limestone dressings), known to the quarrymen as the 'good rock'. It is a dark green-grey, fine-grained stone (andesite) that is indistinctly mottled in parts, caused by its brecciated state. Staining of the joint surfaces gives the occasional block a dull dark red colour.

Figure 3: St Peter's Church, Bardon Hill. Bardon Breccia with Lincolnshire Limestone dressings.

Whitwick Volcanic Complex

Grimley Andesite

This andesitic lava occurs as a massive, weakly cleaved rock in and around Whitwick, and it is exposed in small quarries in the centre of the village. The nature of the stone is evident at the Old Convent in Whitwick, where some enormous blocks have been used in the walls. The stone is very hard and fine grained, and it commonly weathers to a strong red colour. It may be mottled, with the original dark grey-green shades still visible. It is used as rubblestone, in association with other local Charnian rocks, in building and boundary walls up to 4km from its outcrop.

Figure 4: Old Convent, Whitwick. Grimley Andesite.

Peldar Dacite Breccia

The large quarry at Whitwick, west of the village, is the source of two distinctive stones: Peldar Dacite Breccia and Sharpley Porphyritic Dacite. The former is a dark grey to greenish-grey, fine-grained lava, enclosing blobs of very similar coarser grained lava with large crystals (phenocrysts) of quartz and cloudy grey feldspar. The quartz crystals are unusually dark and full of fractures.

Weathered surfaces can appear uneven, showing a corrugated texture. Joint surfaces often weather to a cream or rusty brown colour. Both stones have been used with other local stones across north-west Charnwood Forest. Peldar Dacite Breccia is conspicuous in the lower stage of the tower at St Mary's Church at Osgathorpe and it is also seen in nearby houses (up to several kilometres from Whitwick). It is one of the stones used in the walls of Mount St Bernard Abbey, near Coalville.

Figure 5: Mount St Bernard Abbey, near Coalville. Peldar Dacite Breccia.

Sharpley Porphyritic Dacite

This is best seen in the walls of St John the Baptist's Church at Belton. It is a fine-grained, pale grey to pale purple stone, with large (up to 5mm) phenocrysts of transparent grey quartz and cloudy grey feldspar. The distinctive features of this stone are the purple hues and preferential weathering of the matrix, which leaves the larger crystals upstanding. Joint surfaces may be cream or brown in colour.

Blackbrook Group, Maplewell Group

The Precambrian igneous intrusions in the Charnwood Forest, formed between about 650 and 540 million years ago, have been divided into three major stratigraphical units: the Blackbrook Group, the Maplewell Group and the Brand Group. These collectively make up the Charnian Supergroup.

The older buildings, especially the medieval churches, tend to include a wide variety of Charnian rock types. With the exception of Ulverscroft Priory, near Markfield, all the medieval churches and other structures are located on the periphery of Charnwood Forest. In contrast, the Victorian and later churches tend to display a single stone type in their wall fabric.

The Charnian rocks are very hard and they are almost invariably used in buildings and walls as uncoursed, angular rubblestone. All of them are cleaved to some extent. The cleavage and joint planes determine the shape of the blocks, and these surfaces often weather to shades of red, brown or cream, quite different from the common greys and greens of the fresh stone. A single wall can, consequently, appear to be composed of several different stone types when it is actually built of just one or two, with varying degrees of weathering.

When used as building stone, the magmatic lithologies (lavas and intrusive rocks) are easier to identify than most of the varied fragmental volcaniclastic lithologies of the Charnian sequence. For this reason, the magmatic stones have been named and described individually, whereas the volcaniclastic stones have been grouped by lithological type.

The Charnian volcanoes formed part of an island arc and were explosively active (albeit intermittently) for several tens of millions of years. Huge volumes of pyroclastic debris, ash, tuff and other fragmentary volcanic rocks, were erupted and deposited in the surrounding sea. Together with finer sediments eroded from the flanks of the volcanoes, these built up a great thickness of volcaniclastic sediments. Much of the material was sorted by grain size as it settled, giving a banded appearance to the rocks, particularly the finer beds of sandstone and tuff.

Blackbrook Group, Maplewell Group, unassigned formations

Charnian volcaniclastic sandstone

The oldest volcaniclastic rocks crop out in central and north-west Charnwood Forest. These are assigned to the Blackbrook Group. The term ‘Charnian volcaniclastic sandstone’ has been applied to any sandstone, arenaceous mudstone or siltstone from this unit. The stones are particularly dense and show graded bedding and banding related to particle size variation (mud to sand grade). This can result in colour banding, from pale grey to greenish-grey and dark grey. Overall, they are a darker colour than the other striped Charnian stones, including the banded tuffs.

Use of Charnian volcaniclastic sandstone is notable in and around the village of Shepshed such as Blackbrook Farmhouse, where the stone probably came from local quarries at Morley, Blackbrook and Newhurst. Charnian volcaniclastic sandstone is used in St Mary’s Church at Nanpantan.

Figure 6: Blackbrook Farmhouse, Shepshed. Charnian volcaniclastic sandstone.

Charnian volcaniclastic breccias

Interbedded with the finer Charnian units are occasional beds containing abundant angular to sub-rounded volcaniclastic rock fragments (20mm to more than 100mm in size), set within a matrix of finer debris.

A few angular blocks of such breccia can be seen in most building and field walls constructed of mixed Charnian rocks. The colour of these stones varies, depending on the source, but they are often grey or greenish-grey. The larger clasts can be prominent due to differential weathering of the components.

Charnian crystal tuffs

The fine-grained debris of a volcanic explosion can produce a rock comprising crystals and crystal fragments set within a finer grained matrix. Variable weathering of the mineral components may produce a speckled appearance, although the overall colour is usually grey or grey-green.

Crystal tuffs are found throughout the Maplewell and Blackbrook groups and, therefore, right across Charnwood Forest. However, many are not true crystal tuffs because they may also contain lithic or glassy fragments. The only crystal tuff that has been identified and named in a building is the St Bernard Tuff, which was quarried on site and used extensively in Mount St Bernard Abbey and older surrounding buildings.

Blackbrook Group, Maplewell Group, Charnwood Lodge Volcanic Formation

St Bernard Tuff

This is a grey, massive, lithic-crystal tuff. In the walls of Mount St Bernard Abbey, it was used in sub-angular slabs from 200mm to 900mm long. At outcrop (St Bernard Tuff Member), the rock unit passes up vertically into a

Figure 7: Mount St Bernard Abbey, near Coalville. Peldar Dacite Breccia and Mount St Bernard Tuff.

volcanic breccia and a thinly bedded, graded crystal tuff. However, these lithologies are not evident in the abbey building stones. Weathered joint surfaces are cream and pale brown in colour. There is a small quarry adjacent to the abbey and other small pits in nearby fields.

Charnian banded tuffs

These are very hard, fine-grained, volcaniclastic rocks, made up of andesite and dacite clasts, with some volcanic ash. They are pale in colour, light grey or green when fresh, but often weather to a creamy-white or pale pink colour. At outcrop, they are typically thinly bedded or laminated, although massive in parts, and they show a slight colour banding that reflects the grain size variation. The stone is poorly cleaved, and it is sufficiently well indurated that it can only be broken along joint and cleavage planes to produce a sharply angular rubblestone. It is used in vernacular buildings and drystone walls along with other Charnian rocks throughout the Charnwood Forest area. The crags of Beacon Hill are a good place to see Charnian banded tuffs at outcrop.

Figure 8: Charnian banded tuffs.

North Charnwood Diorites, South Charnwood Diorites

North Charnwood Diorite, South Charnwood Diorite (Markfieldite, Groby Granite)

During the later stages of the Charnian volcanic activity, or shortly afterwards, two contrasting suites of igneous bodies were intruded into the accumulated volcaniclastic debris. In north Charnwood Forest, relatively thin (up to 60m wide), near-vertical sheets of diorite (North Charnwood Diorites) form north-west to south-east trending ridges in today's landscape. The younger intrusions (South Charnwood Diorites) solidified from a more silicic and calc-alkaline magma. They form a general mass several kilometres in extent around the southern edge of Charnwood Forest, flanking the route of the A50 between Leicester and Coalville.

This very hard, dense rock forms the elongate hilltops west of Copt Oak, north of Bawdon Castle Farm and at Buck Hill near Nanpantan. The northernmost outcrops were worked in quarries at Longcliffe and Newhurst near Shepshed. North Charnwood Diorite is a very dark grey rock with abundant large, grey, feldspar crystals set within a fine to medium-grained matrix, giving an overall mottled texture. It is a minor component in the walls of St Botolph's Church at Shepshed.

Figure 9: St Botolph's Church, Shepshed. North Charnwood Diorite.

Figure 10: St Botolph's Church, Shepshed. North Charnwood Diorite.

South Charnwood Diorite was quarried at several sites near Markfield and also a few kilometres to the south-west, near the village of Groby. The worked stone is a hard, massive, medium to coarse-grained igneous rock, with a speckled appearance. From the mid-19th century, it has been quarried and exported across southern England, principally as aggregate, small paving setts and kerb stones. Locally, it was also used for building foundations and as angular rubblestone, occasionally squared, in boundary walls, cottages and the two village churches, where differences between the stone from the two centres can be observed.

Figure 11: Cottage, Newtown Linford. South Charnwood Diorite.

The St Philip and St James Church at Groby was built in 1840, when there was a small busy quarry located immediately opposite, on what is now an industrial site. The main quarry at Groby, north-east of the village, was opened around 1880 by the Groby Granite Company, when the village quarry was worked out. The stone in the church is predominantly dark pink in colour, comprising pink to red feldspars, grey to colourless quartz and minor amounts of dark ferro-magnesian minerals. South Charnwood Diorite from Groby was used in Newtown Linford and in the church tower at Groby.

Figure 12: St Philip and St James Church, Groby. South Charnwood Diorite tower.

By comparison, the Markfieldite stone in the 12th-century St Michael and All Angels Church at Markfield (extended and restored in 1865 after Markfield Quarry opened) is an overall darker grey colour. It is composed of green to grey feldspars set within a pink to grey matrix, and it contains about 40 to 50 per cent dark green to black ferro-magnesian minerals. The stone is now worked at the much larger Cliffe Hill Quarry nearby.

Figure 13: St Michael and All Angels Church, Markfield. Charnwood Diorite.

Cambrian

The Cambrian rocks of Leicestershire are found on the eastern and southern fringes of Charnwood Forest. They are assigned to the Brand Group (the uppermost part of the Charnian Supergroup), which is subdivided into the Brand Hills Formation and the Swithland Formation.

Brand Group, Brand Hills Formation

Stable Pit Quartzite

South-west of Leicester and across south-western Leicestershire generally, a hard, medium-grained quartz arenite is infrequently seen in building walls. Even then, it tends to be a minor constituent. It is used in small, squared rubblestone blocks of uniform texture and pale grey colour.

Close to Leicester, where the stone may have a dull brown tint, it is thought that the blocks came from the Stable Pit Quartzite, of which there are very small outcrops in Bradgate Park and near to the villages of Groby and Field Head. In the south-west of the county, the blocks are more likely to have been sourced from the broadly contemporaneous Hartshill Sandstone Formation of neighbouring Warwickshire.

Brand Group, Swithland Formation

Swithland Slate

The youngest unit of the Brand Group, the Swithland Formation, but more commonly known as the Swithland Slate, formed the basis of a thriving local industry during the 18th and 19th centuries. It consists of mildly metamorphosed silty mudstones and siltstones, with an irregular but closely spaced cleavage that allows the stone to be split. The less silty horizons were selected for thick, size-graded roofing slates, which were used county-wide and a little beyond. The remainder (and, in fact, the bulk) of the formation was used locally as a slabby rubblestone in building and boundary walls. The stone is dark grey, dark purple, dark green-grey and, very occasionally, pale green where silty laminations occur in the mudstone. The main quarries were near to the villages of Swithland and Woodhouse Eaves in east Charnwood, Forest and at Groby in south-east Charnwood Forest. The industry declined with the arrival of the railways during the mid-1800s, which led to the import of cheaper and lighter Welsh Slate. The last Swithland Slate quarry had closed by 1888. This attractive stone is still in demand today, but at present it can only be obtained from recycled sources. Entire houses are built of Swithland Slate in the villages of Swithland, Woodhouse and Woodhouse Eaves.

Figure 14: Cottage, Woodhouse Eaves. Swithland Slate.

Figure 15: Almshouses, Woodhouse Eaves. Swithland Slate.

Figure 16: House, Woodhouse Eaves. Swithland Slate.

The Church of St Paul at Woodhouse Eaves stands directly above the historic Woodhouse Eaves Quarry. Thick Swithland Slate was commonly used in diminishing sized courses for roofing because the quarries were unable to produce sufficient single-sized slates. They, therefore, had to make full use of the variably sized random slates available.

Figure 17: Woodhouse Eaves quarry. Swithland Slate.

Figure 18: Roof of the Church of St Paul, Woodhouse Eaves. Swithland Slate.

Ordovician

Mountsorrel Complex, South Leicestershire Diorite Complex

Mountsorrel Granodiorite (Mountsorrel Granite), South Leicestershire Diorite

Plutonic igneous rocks of Ordovician age, which are believed to be representative of a single intrusive episode, occur both to the north and south of Leicester. The magma chemistry seemingly evolved through time, such that the resultant rocks are of variable composition, ranging from granodiorite to diorite, and even gabbro, in one quarry. They are assigned to either the Mountsorrel (Complex or the South Leicestershire Diorite Complex. These two intrusive complexes comprise medium to coarse-grained, hard, massive, crystalline rocks.

The Mountsorrel Granodiorite, frequently, but inaccurately, known as Mountsorrel Granite, crops out to the east of Charnwood Forest near the village of Mountsorrel, where there is a large active quarry. The stone is worked primarily for aggregate.

The South Leicestershire Diorite Complex has relatively small outcrops to the south-west of Leicester, forming a line of hills from Enderby to Sapcote. Of these, only the Croft outcrop is still being exploited, and the extraction is in the floor of the exceptionally deep quarry. Several quarries have been infilled or flooded, whereas others have been abandoned or enclosed by urban development.

The relative proportions of quartz, feldspar and ferromagnesian minerals, and also the size of the constituent crystals, control the colour and texture of these speckled rocks. When seen as a building stone, the Mountsorrel rocks tend to be pale pink to dark red, while the South Leicestershire Diorites range from pink to purplish-grey. They are used as angular rubblestone, giving rise to a crazy paving effect, although the blocks were occasionally squared. The stone is very hard, and it has commonly been used for footings and foundations, but never for decorative carvings.

In the 19th century, paving setts and kerb stones made of Mountsorrel Granite were exported to towns across England. Many Victorian churches, village halls and houses were built or restored using these stones, and in recent years they have been employed for church extensions. The Mountsorrel stone is used in central north Leicestershire, and the quarries at Croft, Enderby and Sapcote supplied stone to the south and south-west of the county.

Figure 19: Tower, Holy Trinity Church, Barrow-upon-Soar. Mountsorrel Granodiorite.

Figure 20: Cottages, Quorn. Mountsorrel Granodiorite with Swithland Slate roof.

Carboniferous

Carboniferous rocks are found in the north-west of the county. Inliers of the Lower Carboniferous Peak Limestone Group form the hills at Breedon and Castle Donington, whereas Upper Carboniferous Coal Measures Group strata occupy much of the area around Ashby de la Zouch and are part of the Leicestershire and South Derbyshire Coalfield. The limestones have been used only to a very limited extent as a building stone. Although sandstones do occur within the restricted Millstone Grit and Coal Measures sequences, none are known to have been worked locally for building stone.

Carboniferous limestone has been used as dressed rubblestone in St Mary's Church at Osgathorpe, Grace Dieu Priory (ruinous) near Thringstone and vernacular buildings in the village of Breedon on the Hill and the nearby hamlets of Tonge and Isley Walton. It is given several local names, depending on the area where it has been quarried and used. Carboniferous limestones in Leicestershire are mostly dolomitic, unlike those of Derbyshire.

Peak Limestone Group, Milldale Limestone Formation

Breedon Stone

There are large working aggregate quarries at Breedon on the Hill and Cloud Hill, yet there has been only limited use of the stone in local boundary walls and buildings. It is a hard, fine-grained, often red dolostone, with some fossil casts and rare traces of shell debris. It is used as an angular rubblestone and as squared, variably sized, dressed blocks, notably in a few decorative rustic buildings. Although the stone is cream to pale fawn in colour when first quarried, coatings of lichen often make buildings look grey. Despite being perched on the hill directly above the quarry, the Church of SS Mary and Hardulph at Breedon is built of Millstone Grit. Bromsgrove Sandstone and Bulwell Stone have also been used in its construction and conservation.

Breedon Stone was used for a small memorial building on the green at Breedon on the Hill.

Figure 21: War memorial, Breedon on the Hill. Breedon Stone.

Figure 22: War memorial, Breedon on the Hill. Breedon Stone.

Peak Limestone Group, Ticknall Limestone Formation

Grace Dieu Stone

There is a very small outcrop of the Ticknall Limestone Formation near to Grace Dieu Priory. This appears to have been worked and used to a minor extent, along with Charnian rocks, in the old chapel walls of the building. The stone itself is a very fine-grained, grey, massive limestone. Large bivalve fossil fragments are common. It is simply used as an angular rubblestone.

Peak Limestone Group, Cloud Hill Dolostone Formation

Osgathorpe Dolomite

This is a very fine-grained, cream-coloured dolostone with fossil casts and many small voids. It is used in association with a conglomeratic stone containing dolostone pebbles in St Mary's Church at Osgathorpe. Both stones are believed to have come from the quarry on Barrow Hill, just above the village. The latter is described with the Triassic rocks.

Millstone Grit Group, Morridge Formation

Morridge Formation Sandstone, Millstone Grit Sandstone

This is a hard, massive, medium to coarse-grained, grey to fawn-coloured, fluvial sandstone, composed mainly of rounded grains of quartz and feldspar, with scattered mica flakes. It is variably cross-bedded and may show banding as a result of grain size variation. Breaks in sedimentation are indicated by very small quartz pebbles and rare thin layers of ferruginous grains, which can give rise to a weak brown staining. The stone may have a speckled appearance.

Millstone Grit sandstone has been used as a durable freestone, the ashlar blocks of which have sometimes been given a decorative tooled finish. It is used extensively in all but the eastern parts of the county for dripstones and for repairs, particularly on quoins, buttresses and other exposed elevations.

The sandstone crops out near the village of Thringstone, but there is no evidence of it having been used there. It was quarried just over the county boundary in South Derbyshire, around Melbourne, Stanton by Bridge and to the north of Ashby de la Zouch. However, these sources are probably too far removed for it to have been employed as a primary building material in Leicestershire during the medieval period. Its use in the county increased in the 19th century, and several Victorian churches and extensions in north and north-west Leicestershire are built entirely of Millstone Grit sandstone. St John the Baptist Church at Old Dalby and Emmanuel Church at Loughborough are excellent examples of the use of imported Millstone Grit sandstone during the 19th century.

Figure 23: St John the Baptist Church, Old Dalby. Millstone Grit Sandstone.

Figure 24: Emmanuel Church, Loughborough. Millstone Grit Sandstone.

Triassic

Sedimentary rocks of Triassic age accumulated, for the most part, in a semi-arid desert environment, within an area of significant, but reducing, topographic relief. They crop out across western Leicestershire and comprise the Sherwood Sandstone Group, the Mercia Mudstone Group and the Penarth Group.

At the end of the Carboniferous, substantial earth movements resulted in the folding, faulting and uplift of the Carboniferous succession. Subsequently, the Permian was a time of intense erosion across Leicestershire, although marine conditions prevailed to the north of Nottingham. Thereafter, when sedimentation resumed in the Early Triassic, extensive river systems deposited the coarse gravels, and then sands, that now comprise the Sherwood Sandstone Group.

Sedimentation continued during the Middle and Late Triassic, depositing the mudstone-dominated succession of the Mercia Mudstone Group. Gradually, the upland areas of Charnwood Forest and the isolated Carboniferous outcrops became buried, with the highest points remaining as rugged, upstanding tors. Screes developed in places against the areas of high ground, while fluvial, lacustrine and aeolian deposits accumulated towards the basin centres. Erosion and burial of the upland areas were completed by Late Triassic times, when marine and brackish water conditions prevailed during the deposition of the marginal marine limestones and mudstones of the Penarth Group.

Sherwood Sandstone Group, Kidderminster Formation

Kidderminster Sandstone (Bunter Pebble Beds)

The Kidderminster Formation was probably the source of the large Bunter pebbles that are seen in buildings across the county. The sandstones are yellowish-brown to brownish-red, medium grained and friable. They crop out south-west of Ashby de la Zouch and are the probable source of red and yellow ashlar sandstone used in Ashby de la Zouch Castle and for repairs to churches in south and west Leicestershire.

Figure 25: Ashby de la Zouch Castle. Kidderminster Sandstone.

Sherwood Sandstone Group, Bromsgrove Sandstone Formation

Bromsgrove Sandstone, King's Mill Stone, Kegworth Stone

This is one of the most important building stones in the county. It is composed of fine to medium-grained, well-sorted quartz sand with small-scale sedimentary structures, including planar and cross-bedding and occasional convoluted bedding (probably the result of dewatering during compaction). Bromsgrove Sandstone is generally pale green-tinted grey to fawn in colour, although some infrequently observed reddish-fawn to pale brick red sandstones might also be from this formation.

It can be easily sawn and provided a good ashlar stone in large blocks up to 900 by 350mm. Blocks are generally used with a flat finish, but occasionally dressed to give a textured surface with a flat, untooled margin. The sandstone is used in all parts of a building but may be susceptible to boring by insects and to damp, frost penetration and wind erosion in exposed places. This may lead to exfoliation and extreme honeycomb weathering in some instances.

Figure 26: Insect damage to sandstone.

Figure 27: Weathering and exfoliation damage to sandstone.

Bromsgrove Sandstone is used extensively throughout west Leicestershire, where it is the principal stone in numerous churches. It has been used for quoins and decorative work in many of the rubblestone churches, and for repair work over a wider area. Notable examples are the Church of St Laurence at Measham, the Church of St Matthew at Chilcote, the Church of the Holy Rood at Packington and the Church of St Peter at Market Bosworth, among many others. Bromsgrove Sandstone was used for the beautiful carving at Ulverscroft Priory near Markfield, the walls of which are of Charnian stones. The stone for the small church at Chilcote was quarried just 100m away, from a small quarry at the roadside opposite.

Figure 28: Stone carving, Ulverscroft Priory. Bromsgrove Sandstone.

The sandstone crops out around the margins of the Leicestershire and South Derbyshire Coalfield, and it has been quarried in the north-west of the county at Castle Donington and Kegworth, where it was known as King's Mill or Kegworth Stone. The King's Mill Stone contains pebble bands, which makes it unsuitable for decorative work. It can sometimes be difficult to distinguish Bromsgrove Sandstone from some of the finer grained varieties of Millstone Grit, and the place of use offers no assistance because both stones would have had to travel some distance to be used in certain parts of Leicestershire. Generally, though, Bromsgrove Sandstone is finer grained and a little more friable.

Pebbly sandstones, Shepshed Sandstone

Pebbly sandstones are locally developed within the Bromsgrove Sandstone Formation. Lithologically, they are medium to coarse-grained, usually grey but occasionally pinkish sandstones, with sub-angular to rounded pebbles of a few millimetres to more than a centimetre in size. These are compositionally variable, but mainly quartzo-feldspathic, and they may be either randomly scattered or aligned in the cross-bedding. The pebbly sandstones represent a marginal facies of the formation, deposited by tributary streams draining the Triassic mountains. One such pebbly sandstone horizon, containing small angular and rounded pebbles of Charnian rocks, is known as the Shepshed Sandstone. It is a very minor component of the church walls at St John the Baptist's Church at Whitwick, All Saints' Church at Newtown Linford and St Botolph's Church at Shepshed. Similar rock is used in St Denys' Church at Ibstock and All Saints' Church at Nailstone.

Figure 29: Pebbly sandstone including small angular Charnian pebbles.

Mercia Mudstone Group

This thick, mudstone-dominated, red bed sequence accumulated in a hot, arid desert with ephemeral rivers and extensive playa lakes. The area was subject to periodic flash floods, which deposited thin, laminated, very fine-grained sandstones known as Skerries. These occur throughout the sequence, and they were used extensively in the older buildings and vernacular structures.

Mercia Mudstone Group, Gunthorpe Formation

Osgathorpe Conglomerate

The Osgathorpe Conglomerate, recognised only in Osgathorpe village church, comprises pale buff, sub-rounded, dolomite pebbles set within a weakly cemented, gritty, dolostone sandy matrix. It is believed to have come from Barrow Hill Quarry, together with the Carboniferous Osgathorpe Dolomite. It probably occurs as a breccio-conglomerate within the Gunthorpe Formation, the pebbles being eroded from and deposited against the Carboniferous limestone hills in the Triassic desert.

Skerry Sandstones

The thinly bedded Skerry Sandstones are composed of pale grey, finely laminated, very fine-grained, dolomitic sandstone, with thin, greyish-green clay partings. Commonly, they are finely cross-bedded and frequently show intense distortion and convolutions caused by dewatering. The stone is used as thin rubblestone slabs.

Figure 30: Cottage, Orton on the Hill. Skerry Sandstone.

Figure 31: Cottage wall, Orton on the Hill. Skerry Sandstone.

Diseworth Sandstone

The Diseworth Sandstone crops out locally to the north of Shepshed. A pale grey to yellow-grey, fine-grained sandstone, it has been used as a squared freestone and as rubblestone in the Church of St Michael at Diseworth and in village buildings along Hall Gate to the west. It has also been employed in boundary walls towards Long Whatton. The grains are mostly of quartz with evenly scattered darker grains. The stone is largely planar bedded, but often shows cross-bedding, with horizons of spheroidal cavities up to 10mm across, infilled with clear crystalline gypsum.

Stone for some of the village buildings is said to have been dug from shallow pits in fields on the north-east side of Diseworth. One exceptionally large block in the formation has been laid with the bedding plane vertical, showing superb ripple marks. Most of the houses on Grimes Gate, Diseworth, have footings and garden walls built of the Diseworth Sandstone.

Figure 32: Houses, Grimes Gate, Diseworth. Diseworth Sandstone footings and garden walls.

Mercia Mudstone Group, Arden Sandstone Formation

Hollygate Sandstone, Upper Keuper Sandstone, New Parks Stone, Dane Hills Sandstone

Small outcrops of a distinctive stone used in central Leicestershire can be seen where it was once quarried, in what is now Western Park in the western suburbs of Leicester. It is a pale grey to almost white, fine-grained sandstone with rounded grains, which are almost entirely of quartz. It is either massive or weakly cross-stratified, yielding dressed blocks of up to 1 by 0.4m in size. The stone develops a mid to dark grey weathering crust. When this crust is breached, the sandstone becomes very friable, and it was sometimes crushed to produce building sand.

Hollygate Sandstone (also known as Upper Keuper Sandstone, New Parks Stone, or Dane Hills Sandstone) is found as a minor component in church walls from Rothley, just north of Leicester, to villages a few miles south-west of the city. It is best seen in Leicester itself, however, where it is a major component in St Nicholas' Church and in the old castle walls. Exceptionally, it was used as the main building stone for the early 17th-century Cavendish House in Abbey Park, for which the stone is said to have been recycled from the adjacent ruined abbey.

Figure 33: Cavendish House, Abbey Park, Leicester. Hollygate Sandstone and Dane Hills Sandstone.

Penarth Group, Lilstock Formation

White Lias

White Lias is the traditional name of the youngest limestone beds of the Triassic Penarth Group. The laterally impersistent beds range in thickness from a few centimetres to (exceptionally) 3m over short distances, and they occur sporadically in the north of the county. Use of the White Lias as a building stone is similarly sporadic: it is employed as partly dressed rubblestone in buildings or as rubblestone in field walls within and between the villages of Cotes, Hoton and Wymeswold, where it may have been gathered from field brash.

Jurassic

About 200 million years ago, sea levels rose, submerging the Triassic deserts of Leicestershire. Thereafter, marine conditions generally prevailed. At times, the water was sufficiently shallow to enable the deposition of limestones, many of which are the source of the building stones that characterise the architecture of the eastern half of Leicestershire.

Lower Jurassic

Lias Group, Blue Lias Formation, Scunthorpe Mudstone Formation

Blue Lias

Blue Lias is the traditional name for the basal strata of the Lias Group. These rocks are now assigned to the Scunthorpe Mudstone Formation to the north of a line running roughly from Loughborough to Melton Mowbray and to the Blue Lias Formation to the south of this.

Both units comprise alternations of fine-grained, blue-grey to dark grey, micritic limestones and mudstones. The clay content of the limestone varies, and the limestones with a high proportion of clay are slightly darker and weather with rounded corners.

At outcrop, the limestone beds frequently have regular close-spaced joints. Some of these have pyritic/calcitic coatings, which, when used as facings, weather to a brown colour. More commonly, however, percolating iron-rich water forms patchy, pale cream-coloured joint surfaces.

The more calcareous beds can be easily split by wedges. Weathering often exposes sub-parallel lamination, which is not visible in the fresh rock but very evident in the weathered building stones. Fossils are small and concentrated on the bedding planes. The limestone is easily dressed to provide a blocky rubblestone, comprising thin slabs, 100 to 150mm thick, which are often coursed according to size in buildings.

The Blue Lias outcrop extends roughly north to south through Leicestershire, to the east of the River Soar and along its tributaries. It was extensively worked at Barrow-on-Soar and in the eastern part of Leicester for the manufacture of cement. Selected beds were quarried for diverse domestic uses: wallstones, floor slabs and even the carving of stone sinks.

It is not a major building stone in the county, and it is rarely used for an entire building. However, it has been widely used for small-scale repairs. Of the few houses in which Blue Lias (in this case the lowermost Barnstone Member of the Scunthorpe Mudstone Formation) is the principal building stone, an outstanding example is Bishop Beveridge House in Barrow-upon-Soar.

Figure 34: Beveridge House, Barrow-upon-Soar. Blue Lias.

Wreake Limestone

The name ‘Wreake Limestone’ is herein informally applied to a series of dark grey, shelly (oyster-rich) limestones occurring within the Granby Member of the Scunthorpe Mudstone Formation around Hoby in the Wreake Valley. These limestones contain very little clay matrix, and the shells stand proud on weathered surfaces. Wreake Limestone is used as a rubblestone, occasionally squared, in building and boundary walls, most notably in the Church of St Michael and All Saints located within the grounds of Brooksby College and the Church of All Saints at Rotherby.

Sileby Limestone (Fen Farm Limestone)

This is a richly bioclastic, very pale grey to white limestone in which oyster shells again predominate. These form layers separated by thin, calcareous, clay partings and scattered thin layers containing brown limonite grains. Other fossils present include thin, finely grooved sea urchin (echinoid) spines (up to 20mm long) and pentacrinoid ossicles (2 to 3mm in diameter).

The Sileby Limestone occurs in thin slabs and is a weak, poorly cemented stone. Surprisingly, it is not prone to surface weathering. Like the Wreake Limestone, it is thought to come from within the Granby Member of the Scunthorpe Mudstone Formation.

The Sileby Limestone has only been found used in the walls of St Mary's Church at Sileby and in garden walls in Hoton. In the villages of Hose and Redmile, a muddy micritic limestone with large Gryphaea (extinct oysters) is used in the boundary walls of the churchyards. This probably gives rise to the proximal escarpment that bisects the Vale of Belvoir and is thought to be the Fen Farm Limestone of the Granby Member.

Figure 35: Churchyard walls, St Peter's Church, Redmile. Fen Farm Limestone.

Lias Group, Dyrham Rock Formation, Marlstone Rock Formation

Dyrham and Marlstone Rock formations were formerly grouped together as the Marlstone Rock Bed. During the 19th century, the Marlstone Rock Bed was described as a variable sequence of ooidal ironstones with bioclastic limestones that overlay beds of sandy limestone known as the sandrock. The upper part of the unit contained beds of iron ore quality, while the sandrock beds were recognised as the best building stone.

Sandrock

The sandrock has an impersistent outcrop, thinning to the south, which can be traced from Belvoir almost to Tilton on the Hill; it has not been recognised south of Tilton. It is a calcareous and ferruginous sandstone, with interbedded shelly limestones that have a sideritic muddy matrix. Across north-east Leicestershire, the sandrock and, indeed, the sandy limestones of the Marlstone Rock Formation have been used as building stone. The dominant sandrock lithology is a yellow-brown, fine to medium-grained, limonitic sandstone, very slightly micaceous, with scattered shell debris and

narrow vertical burrow traces. Belemnites and small bivalves are sparsely present, and brachiopods, particularly terabratulids, occur in occasional clusters or ‘nests’. These sometimes stand proud of surrounding weathered stone by as much as 100mm. The rock was used as a freestone, but it is porous and readily suffers from the effects of weathering in exposed settings. The stone was used extensively for dressings in ironstone churches, but few window and door dressings survive. Commonly, they were repaired with Lincolnshire Limestone.

Figure 36: St John the Baptist Church, South Croxton. Sandrock.

Figure 37: Brachiopod 'nests'. Sandrock.

Figure 38: Yew Tree Farm Cottage, Holwell. Sandrock.

Lower — Middle Jurassic

Lias Group, Inferior Oolite Group, Marlstone Rock Formation, Northampton Sand Formation

Historically, the name 'ironstone' is applied to rocks, usually limestones or sandstones, that have a significant iron content (up to about 30 per cent). Leicestershire's ironstones occur at two different stratigraphic levels.

The older ironstones sit within the Lias Group in the Marlstone Rock Formation and the closely associated sandrock of the Dyrham Formation. These are extensively developed in the north-east of the county, capping the higher ground, including the Belvoir escarpment. The younger ironstones, meanwhile, lie within the Northampton Sand Formation of the Inferior Oolite Group, which is limited to small hilltop outliers around Waltham on the Wolds, Loddington and Nevill Holt in the south-east. Both are major sources of building stone and contain beds sufficiently enriched to have been worked as a source of iron.

Both of the Leicestershire's ironstone sequences were deposited as shallow, marine, sandy sediments, in which original carbonate particles, such as ooids and shell fragments, were replaced by the iron minerals siderite (grey iron carbonate) and berthierine (a green iron silicate).

The unweathered ironstones have a greenish-grey colour. Very rarely, 'blue-hearted' rock can be seen where the core of a block has been completely protected from the effects of weathering. Secondary limonite (yellow-brown hydrated iron oxide) dispersed through the rock gives it a rusty appearance or is concentrated in ramifying or concentric box-like veins.

Given that both ironstone sequences have a comparable genetic origin and mineralogy, it is not surprising that they yield building stones of similar appearance. Consequently, they can be very difficult to distinguish when they are removed from their outcrop. Each encompasses several lithologies: the sandy ironstones may be found in association with ferruginous fossiliferous limestones and, occasionally, concentrated iron-rich stones. The Marlstone Rock and/or sandrock-derived ironstones were principally used in the north-east of the county, whereas the Northampton Sand-derived ironstones tended to be used in the south-east. However, the boundary between the two is difficult to define. Generally, the Northampton Sand Formation produces stones with a wider range of colours, including a distinctive purple-hearted variety. Both Marlstone Rock and Northampton Sand varieties may be found in some villages, and even in a single building, especially in the central-eastern parts of the county.

Further complications arise if an attempt is made to distinguish between the main building stones produced from the Marlstone Rock and the Dyrham formations.

Marlstone Rock (and varieties)

Both the sandrock and Marlstone Rock ironstones were probably worked from numerous small pits for building stone, but subsequent exploitation of the iron-rich beds (which sit above the building stone units) during the 19th century lowered the surface of the fields, thereby obliterating all trace of many of the stone quarries. Nevertheless, a few of the original building stone workings are still visible, for example at Stonepits Farm near Wartnaby and in the fields east of Holwell. The Marlstone Rock Formation contains several lithological variants, which are found as minor components in buildings and are described below.

None of these building stones are worked in Leicestershire today. Consequently, repairs are generally carried out using stone from the Marlstone Rock Formation quarries at Great Tew, near Banbury in Oxfordshire. This ferruginous limestone has a low iron content and weathers to a pale ochreous brown. However, in texture, it resembles sandrock, with scattered shells, shell debris and burrow traces.

There is a pebble bed at the base of the Marlstone Rock Formation that has, occasionally, found its way into rubble used as building stone, Marlstone Conglomerate. Well-rounded, 10 to 70mm diameter pebbles of limonitic and phosphatic mudstone, often slightly flat/discoidal in shape, occur within a finely comminuted shell debris-rich, lime matrix. The pebbles frequently have a thin dark brown rind. The stone can be seen as a very minor component in association with other Marlstone Rock lithologies in boundary walls in Tilton on the Hill and buildings in Harby.

Marlstone Rock Limestone is a hard bioclastic limestone is found as a minor component in association with other Marlstone Rock lithologies in villages between Harby and Tilton on the Hill, often occurring in lenses within a

single building stone block. Abundant crinoid ossicles and other pale grey shell debris are set within a mid-brown, ferruginous matrix. Traces of cross-bedding are sometimes evident.

Marlstone Rock Ferruginous Sandstone is a general term for the the sandrock-like ferruginous sandstone. It has a higher iron content, thereby yielding a darker, red-brown building stone. It is seen in the village of Holwell.

Occasionally, small lumps of the ore-grade ironstone may be found as rubblestone in building walls. This was originally a highly ferruginous ooidal limestone, which weathering has reduced to a mass of reddish-brown iron oxide veins, with spheroidal oomoldic cavities.

Figure 39: Old Methodist Church, Holwell. Marlstone.

Middle Jurassic

Inferior Oolite Group, Northampton Sand Formation

Northampton Sand (and varieties)

The Northampton Sand Formation crops out at the edge of the uplands around Waltham on the Wolds and caps the steep-sided hill summits east of Tilton and the broader hill at Nevill Holt. Small quarries exist and the Northampton Sand was substantially worked as an iron ore at Nevill Holt. There is no direct evidence that it was quarried for building stone in the county, but its use in association with Nevill Holt Stone suggests that both were extracted from the same place. The Northampton Sand is used extensively in villages in south-east Leicestershire, however, with most of the stone probably imported from the nearby Uppingham district of Rutland and from north Northamptonshire.

The formation comprises a variety of decalcified ferruginous sandy limestones. Northampton Sand is an ochreous brown, ferruginous sandstone can be confused with the dominant sandrock and Marlstone Rock lithologies. The stones tend to be more vividly coloured, varying from the common yellow-brown to yellow-red, red-brown and purple-grey, and slightly coarser grained than their Marlstone Rock Formation counterparts. It is a fine to medium-grained, sometimes bioturbated by large, darker, U-shaped burrows of about 5mm in diameter. It may contain scattered bivalves, brachiopods, crinoid ossicles, calcareous tubeworms (Genicularia vertebralis) and belemnites. It can also display a network of reddish-brown veins of iron oxide, which traverse an ooidal, dark ochreous-brown, ironstone matrix.

A number of lithological variants may be seen in any one building, although all of these were probably obtained from a single quarry.

Northampton Sand is almost invariably used as dressed stone, less frequently as large ashlar blocks and very rarely as rubblestone. Occasionally, it is used decoratively, including for lintels and parapets, and it may contrast in colour with the walling stone, as seen at Nevill Holt school. It ranges from poor to good quality freestone and is generally less susceptible to weathering than Marlstone Rock. However, it is a porous stone, prone to exfoliation, resulting in rounded surfaces in extreme cases. Northampton Sand is used in houses such as those in Melbourne, churches and large houses, including Nevill Holt Hall, as well as in restorations, at St Mary's Church at Stoughton near Leicester, for example, and for minor repairs. Launde Abbey is built from Northampton Sand ironstone, with minor repairs carried out using the Marlstone Rock from Oxfordshire.

Figure 40: Nevill Holt Preparatory School, Nevill Holt. Northampton Sand decorative lintels and parapet.

Figure 41: Cottage, Medbourne. Northampton Sand sandstone.

Figure 42: Launde Abbey, East Norton. Northampton Sand ironstone.

Inferior Oolite Group, Lincolnshire Limestone Formation

The Lincolnshire Limestone Formation is a very important source of building stone that has been worked since Roman times. Quarries in both the Lower and Upper Lincolnshire Limestone members occur along the outcrop, from Lincoln through Rutland into Northamptonshire. Only the lower member occurs in east Leicestershire, on the hilltops at Waltham on the Wolds in the north and at Nevill Holt in the south.

The formation includes a substantial range of lithologies, which directly reflects variations in the relative proportions of its constituents. These include ooids, pisoids, limestone pebbles, quartz sand, shells and shell debris, which may be enclosed in a matrix ranging from lime mud (micrite) to translucent sparry cement. Many well-known building stones are named after the quarry location and type of rock worked, such as Collyweston Stone slate, Wittering Pendle, Ancaster Rag and Ketton Stone.

Shelly, spar-cemented limestones are the most durable stones and they are used for drip courses. Well-cemented ooidal limestones, some with shell debris, are used as ashlar and also for decorative work and window mouldings. A streaky appearance is shown by many Lincolnshire limestones.

No attempt has been made in this guide to name specific varieties of Upper Lincolnshire Limestone, except for the distinctive Ketton Stone of Rutland: a fine, well-sorted, even-grained ooidal limestone.

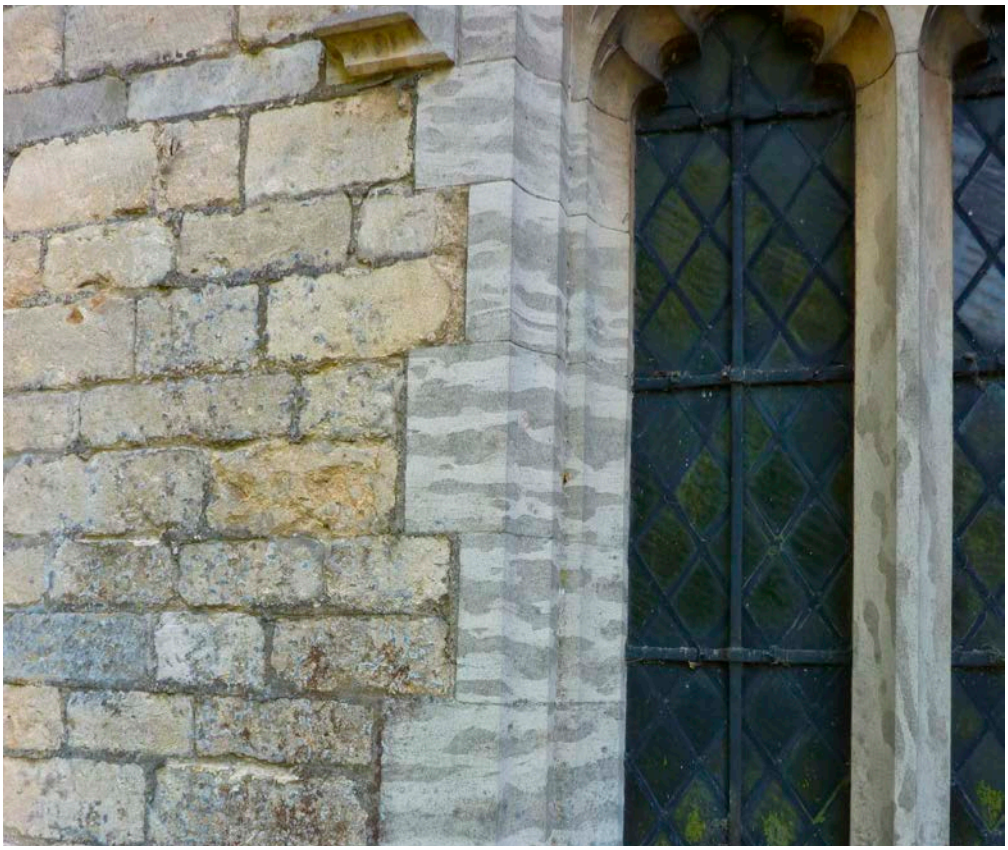


Figure 43: Window moulding. Streaky-looking Lincolnshire Limestone.

Collyweston Stone slate

This fine-grained, thinly bedded, grey, sandy limestone is the source of the Collyweston Stone slate. The limestone is not a true slate, but it is sufficiently thinly bedded to be split into suitable roofing stones. The limestones were dug from shallow mines and brought to the surface in winter. They were then wetted and exposed to the frost, which caused them to split into thin layers. The beds were quarried at Nevill Holt, where attempts to cut the stone mechanically failed. The main workings were around Collyweston in Northamptonshire, where a craft industry still produces small quantities of stone. However, most tiles used now come from recycled sources.

For roofing, the slates are rather heavy, so they are laid in diminishing courses, with the smallest at the ridge and the largest at the eaves. When weathered, the stone is pale greyish-yellow, often developing a patchy, darker grey lichen crust. Collyweston Stone slate is found on a few houses in many villages in south-east Leicestershire, but they are especially common in Medbourne, where the stone is also used in thin slabs for the churchyard wall.

Nevill Holt Stone

Field evidence seems to suggest that this distinctive limestone overlies the basal Collyweston Stone slate unit, a supposition supported by its moderately extensive use in walls in Medbourne and Hallaton (near to Nevill Holt, where the Collyweston Stone slates were once mined). It is found sporadically as far as Kibworth Harcourt, some 12km away. It is a fine-grained, sandy limestone with large, ramifying, nodular burrows up to 20mm in diameter. The unweathered matrix colour is a very pale grey-pink and the burrows are pale fawn. On weathering, however, shades of pale to mid brown develop, and the matrix becomes distinctly ochreous.

Waltham Stone

This is a fine-grained, compact, pale yellow-buff-coloured, micritic limestone, with variable amounts of ooids, shells, burrow traces and finely comminuted bioclastic debris. It is extensively used in the village houses of Waltham on the Wolds, Stonesby and Croxton Kerrial, and for repairs in scattered locations across the north-east of the county. It is used in moderately sized, roughly squared blocks, with the surface left undressed.

In the Church of St Mary Magdalene at Waltham on the Wolds, extensive use is made of another variety of Lincolnshire Limestone: a cream to buff-coloured, medium to coarse-grained, bioclastic, micritic limestone. It is strongly bioturbated, with the irregular ochreous-brown burrows being infilled with a softer grey limestone that readily weathers out to leave a pitted surface. The stone is used in large dressed blocks in various buildings in Waltham and the nearby village of Stonesby.

Figure 44: Cottage. Waltham Stone.

Upper Lincolnshire Limestone (Ketton Stone)

The limestones of the Upper Lincolnshire Limestone Member are more massively bedded and ooidal than those of the Lower Lincolnshire Limestone Member, and they are often better sorted and better cemented. They are

used throughout Leicestershire for dressings, quoins, repair work and, in a few cases, for entire building fabrics, such as the country house and church at Stapleford Park.

Figure 45: Doorway, Church of St James the Greater, Leicester. Upper Lincolnshire Limestone.

Quaternary

Various groups, various formations

Tufa

Tufa is a highly porous, vuggy (with cavities), low-density, grey, freshwater limestone, which has fairly good load-bearing qualities. It comprises a network of casts, formed by the precipitation of calcium carbonate (from spring water) around plant stems, commonly reeds, or any other organic or inorganic fragments in the vicinity. It is rare in Leicestershire and of very localised occurrence. For example, tufa forms most of the facing and infill of the walls of the church ruins at the abandoned village of Knaptoft, south of Leicester. It was also used at Horninghold in the far east-south of the county,

where it is clearly visible in the cottage adjacent to the churchyard. It is also abundantly used in the church itself, although somewhat obscured by a partly removed lime render. In both cases, the source is unknown.

Various geological periods

Various groups, various formations

Pebbles and cobbles

A variety of cobbles and pebbles have been transported into or across the county by palaeo-rivers and glaciers. They are used for minor infill and repairs in many of the older buildings, and sometimes for entire wall facings or as cobble paving. They were probably gathered from local fields and can be up to 300mm in diameter, although most are less than 150mm.

The majority are highly rounded, quartzite cobbles with a brown rind, 'generated' originally in Triassic river systems and subsequently transported by glaciers during the Pleistocene. These very hard sandstones are occasionally face-dressed and rarely squared, exposing the cobbles pale grey interiors.

Some large sub-rounded cobbles of various Charnian lithologies and Ordovician diorites are also found. These have been reworked and transported by ice. Rarely, small angular flints, ice-transported from further afield, have also been used as building materials.

The most extensive use of glacial erratics is in the south-west of the county, especially to the south and west of Leicester and south of Charnwood. Charnian cobbles are notable in garden walls in Newtown Linford and in the Church of St Peter at Thornton. The villages of Kimcote, South Kilworth and Newbold Verdon illustrate the most striking use of Triassic pebbles.

Figure 46: Pebbles.

3 Examples of Imported Stone

As already observed, the stone types most commonly employed in Leicestershire as ashlar and for dressings are in short supply, and much of what has been used was almost certainly imported from neighbouring counties. Notable examples are Millstone Grit from Derbyshire, Bromsgrove Sandstone from Warwickshire and Staffordshire, Upper Lincolnshire Limestone from Lincolnshire and Rutland, and Northampton Sand from Rutland and Northamptonshire. One other relatively local stone has come in smaller quantities from Nottinghamshire, namely Bulwell Stone.

Cambro-Ordovician

Welsh Slate

The only relatively far-travelled import that is used to any great extent in Leicestershire is Welsh Slate. It was employed for roofing buildings throughout the county during the 19th and 20th centuries, replacing the local Swithland Slate.

Late Permian

Zechstein Group, Cadeby Formation

Bulwell Stone

Formerly known as the Lower Magnesian Limestone, this rock was quarried extensively at Bulwell, immediately north-west of Nottingham. Urban growth resulted in the closure of the quarries, however, and the limestone is now worked only at Linby, several kilometres to the north.

The stone was, and still is, supplied as either rubble-faced or sawn ashlar blocks. In colour, it is pale yellow with orange tints, and it can easily be recognised by virtue of its porous, saccharoidal (sugar-like) texture, comprising coarse, rhombohedral crystals of dolomite. It is durable and has been used for repair work and for domestic garden walling at a few locations in the north of the county, as well as for the entirety of St Stephen's Church at New Walk, Leicester.

4 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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