Historic England

Nottinghamshire

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 Stephen Parry and Graham Lott (British Geological Survey).

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Front cover: Southwell Minster. Mansfield White Stone and Derbyshire Bolsover Stone. © Robin Weaver / Alamy Stock Photo.

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

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 Nottinghamshire County Council mineral planning authority area, the Nottingham City Council unitary authority area, and the local planning authority areas of Bassetlaw, Mansfield, Newark and Sherwood, Ashfield, Gedling, Broxtowe and Rushcliffe.

Contents

1 Introduction

Nottinghamshire's distinctive cultural character, very much a product of its history, is strongly reflected in the wealth and variety of its vernacular stone buildings, many of which still stand today. Although Nottinghamshire is not generally considered to be a 'stone county', any study of its historic buildings should not underestimate the importance of its indigenous stone sources. The majority of the county's surviving vernacular buildings are constructed from a range of locally produced materials, including cob (a mixture of clay and straw), brick and stone, all of which were usually dug, quarried or manufactured in relatively close proximity to where they were used. Brick is by far the dominant building material seen in the county, and local brick production dates back to at least the early 16th century. This is evidenced by the surviving south range of Holme Pierrepont Hall, near Colwick, for example. The use of stone for building purposes goes back considerably further, however, in some areas to Roman times. For example, the Roman township of Margidunum, situated adjacent to the Fosse Way between modern-day East Bridgford and Bingham, utilised the local Skerry Sandstone for walling and Swithland Slate (brought in from Leicestershire) for roofing.

More widespread early usage of stone is most evident in the areas surrounding the major quarrying centres of the county (located around Bulwell, Linby and Mansfield), but it is by no means restricted to these parts. Locally quarried stone was in common use over large swathes of Nottinghamshire up until the development of the national canal and

Figure 1: Cropwell Bishop. Various local building stones including Lias, Bulwell Stone, Lincolnshire Limestone.

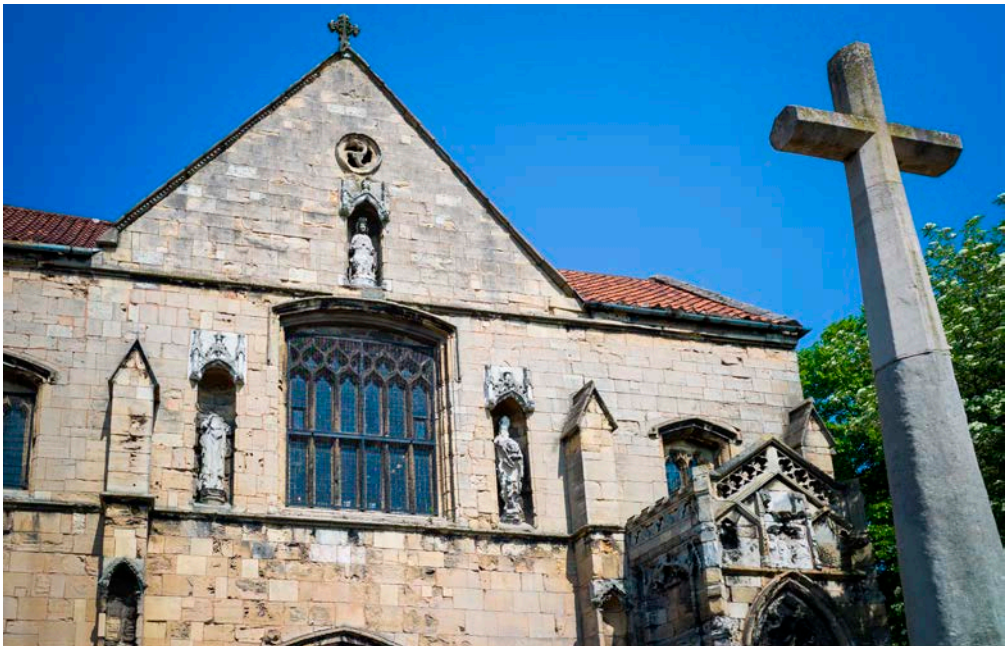


Figure 2: Priory gatehouse, Worksop. Lower Magnesian Limestone.

railway networks during the mid-19th century. This led to the introduction of materials sourced from beyond the county, and these 'imported' stone types are particularly well represented in the larger urban centres, such as Nottingham, Newark (-on-Trent), Mansfield and Worksop.

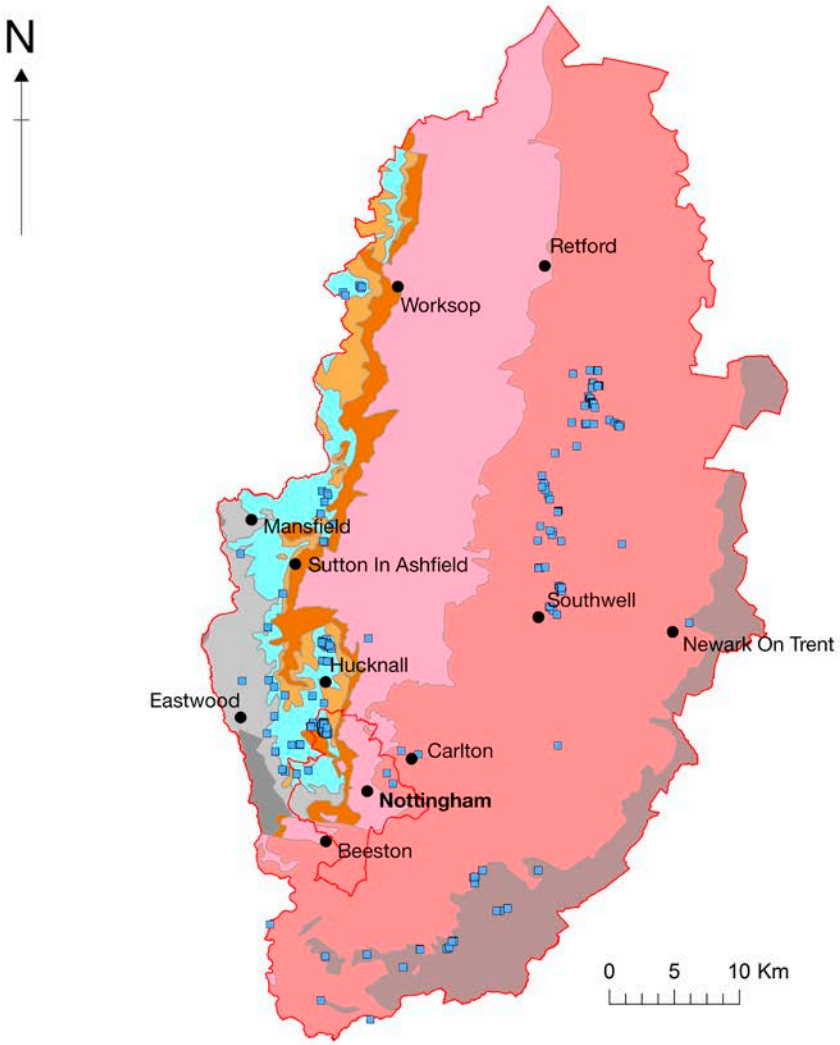
The contrasting nature of the materials used in the buildings and other structures across Nottinghamshire is directly linked to the county's underlying geology. Despite the relative simplicity of its geological succession, comprising a sequence of sedimentary rocks that collectively dip gently eastwards and give rise to an overall north-north-east to south-south-west trending outcrop pattern, there is considerable lithological variety within Nottinghamshire.

The oldest rocks occur in the most westerly parts of the county and are represented by the heterolithic coal-bearing strata of the Carboniferous Pennine Coal Measures Group. These non-marine sandstones, siltstones and mudstones are overlain to the east by the variegated, orange-brown to pale yellow-coloured dolomitic (magnesian) limestones, mudstones and sandstones of the Late Permian Zechstein Group. Together, these two units form the higher ground along Nottinghamshire's western border.

The Late Permian strata are, in turn, succeeded to the east by a thick Mesozoic sequence of red-brown and grey mudstones, sandstones and limestones of Triassic to Lower Jurassic age. This underlies the bulk of the relatively low-lying terrain of central and eastern Nottinghamshire, and in particular the vales of Trent and Belvoir.

Blanketing much of the county, especially along the course of the River Trent, its tributaries and other smaller river systems, are extensive tracts of essentially unconsolidated glacio-fluvial and alluvial sediments (sands, gravels and muds) of Quaternary age. These superficial deposits have yielded (and in some cases continue to yield) a considerable amount of material for the local building industry.

Bedrock Geology Map



Key

Building stone sources

Bedrock geology

- 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
- Permian Rocks (undifferentiated) — mudstone, siltstone and sandstone
- Zechstein Group — dolomitised limestone and dolomite
- 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)

Stratigraphic Table

Geological timescale	Group	Formation	Building stone	Page
Quaternary	various	various	Boulders, cobbles and tufa	18
Lower Jurassic	Lias Group	Marlstone Rock Formation*	Marlstone Rock	17
		Charmouth Mudstone Formation		
		Scunthorpe Mudstone Formation	Lias	16
Triassic	Penarth Group	Lilstock Formation		
		Westbury Formation		
	Mercia Mudstone Group	Blue Anchor Formation		
		Branscombe Mudstone Formation	Gypsum and Alabaster Skerry Sandstone (Skerries)	15 13
		Arden Sandstone Formation		
		Sidmouth Mudstone Formation		
		Tarporley Siltstone Formation	Waterstones Sandstone (Keuper Sandstone)	11
	Sherwood Sandstone Group	Nottingham Castle Sandstone Formation	Sherwood Sandstone	11
		Lenton Sandstone Formation		
Permian	Zechstein Group	Edlington Formation		
		Cadeby Formation	Lower Magnesian Limestone (Bulwell Stone, Linby Stone) Mansfield Red Stone Mansfield White Stone	6
Carboniferous	Pennine Coal Measures Group	Pennine Middle Coal Measures Formation	Coal Measures Sandstone	5
		Pennine Lower Coal Measures Formation		

*Note: The Marlstone Rock Formation crops out just outside of the Nottinghamshire county area.

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

2 Local Building Stones

Carboniferous

Pennine Coal Measures Group, Pennine Lower Coal Formation, Pennine Middle Coal Measures Formation

Coal Measures Sandstone

The lithologically mixed Carboniferous strata that crop out in the west of Nottinghamshire are assigned to the Pennine Coal Measures Group, and more specifically the Pennine Lower and Pennine Middle Coal Measures formations. This unit is renowned from an economic standpoint because of its constituent coal seams, but it also contains a number of hard sandstone beds. These have been quarried fairly extensively for local building stone in the Nottinghamshire and Derbyshire areas, and more so further north in South Yorkshire.

The source of the medium to coarse-grained, cross-bedded Carboniferous sandstone used to construct much of Nottingham's iconic castle (a subsequently remodelled late 17th-century mansion) is not precisely known, but it is believed to have originated from quarries in the Trowell area. Certain older houses and churches in the Selston–Brinsley–Greasley–Cossall area feature local Coal Measures sandstones in their fabrics, as do buildings and boundary walls in and around Trowell and Wollaton. Examples include the Church of St Leonard at Wollaton and the *c* 1500 cottage opposite, which may have been the chantry house. The mudstone horizons of the Carboniferous succession, meanwhile, have been worked for brick clay. They were extensively exploited in the past, most notably in Wollaton and Stapleford.

It is important to note that distinguishing between buff-coloured, cross-bedded sandstones of definite Carboniferous age (and originating from within the Coal Measures succession, specifically) and those of early to mid-Triassic age in the area to the west and south-west of Nottingham is often not straightforward. This is a problem largely created by the paucity of bedrock exposure in this part of the county and the consequent lack of good reference sections. The generally more ferruginous nature of the Coal Measures sandstones, and in particular their content of ironstone and strongly ferruginous mudstone clasts, is currently regarded as a reliable indicator of Carboniferous rather than Triassic origins. This would suggest that the Church of St Wilfrid at Wilford, for example, is constructed of Coal Measures sandstone.

Figure 3: The Chantry, Wollaton. Coal Measures Sandstone.

Figure 4: St Helen's Church, Trowell. Coal Measures Sandstone.

Permian

Zechstein Group, Cadeby Formation

Lower Magnesian Limestone (Bulwell Stone, Linby Stone), Mansfield White Stone, Mansfield Red Stone

The Late Permian Zechstein Group succession fringing much of western Nottinghamshire is subdivided into a variably sandy lower unit of dolostones or dolomitic limestones (the Cadeby Formation) and an upper unit comprising mainly red mudstones, often termed ‘marls’, and sandstones (the Edlington Formation). The beds represent a small section of a long narrow outcrop, running from the Nottingham area to the coast in County Durham.

The Cadeby Formation is the source of the county's best-known building stones. They are typified by an apparently uniform buff-coloured dolostone or magnesium-rich dolomitic limestones, which generally weather to a cream, grey or off-white colour. They were widely used within the outcrop itself and beyond, both as ashlar and as dressings for brick buildings. This formation was once quarried prolifically for building stone at Bulwell, Linby and, further north, in the Mansfield area. The stones produced in these various quarrying areas were named eponymously.

The best-known application of dolostones was in the reconstruction of the Houses of Parliament in the mid-19th century. After a trawl of stones throughout the UK, the committee recommended the stone used in Southwell Minster, Nottinghamshire, which was thought to be from Mansfield Woodhouse (also Nottinghamshire) or Bolsover Moor. There is uncertainty as to whether the Bolsover source was ever used. Eventually, the bulk of supplies came from Anston, just over the border in South Yorkshire.

The stones produced in Bulwell and Linby are highly distinctive, yellow-brown to orange-coloured, coarsely crystalline dolostones (often mistaken for sandstones), and they were widely used for housing, churches, schools and factories. Many of the 19th and early 20th-century suburban developments of Nottingham, such as West Bridgford, have boundary walls constructed of rock-faced blocks of Bulwell Stone. The use of Bulwell Stone is documented as far back as the 16th century, but it is not in active production today.

In medieval times, the Linby quarries supplied stone for Newstead Abbey nearby. They are still operating today, albeit on a limited scale, and supplied stone for the flood defence walls along the River Trent at Wilford and for new-build housing in Papplewick. The central area of the old town at Hucknall retains a number of Linby Stone buildings, including the Church of St Mary Magdalene, several cottages and streets of terraced housing.

Figure 5: Church of St Mary Magdalene, Hucknall. Linby Stone.

The stone also features prominently in the older buildings of Papplewick and of Linby itself. The generally thinly bedded nature of both Bulwell Stone and Linby Stone compromises their use as a freestone. Consequently, other limestones from the Cadeby Formation and the Middle Jurassic Lincolnshire Limestone Formation have been employed for mouldings and other decorative work across the county.

Further north at Mansfield, the Cadeby Formation has yielded two dolostone varieties known as the Red Mansfield Stone and White Mansfield Stone. Of contrasting colour, as their names suggest, these are the only Nottinghamshire-produced building stones to have achieved national recognition from the point of view of their geographical usage. The Mansfield dolostones (strictly dolomitic sandstones at times) tend to have a high quartz sand content and, as a result, are particularly durable. They were extremely popular with architects and builders during the 19th century, and the red variety (long worked out) was desirable for decorative work. Local examples include the Shire Hall, now the National Justice Museum, in Nottingham city centre, Kelham Hall near Newark and numerous shop fronts across the county; national examples include the former Midland Grand Hotel, now St Pancras Renaissance Hotel, in central London.

Figure 6: Shire Hall, Nottingham. Mansfield Red columns.

Figure 7: Southwell Minster. Mansfield White Stone and Bolsover Stone.

White Mansfield Stone, which was still quarried until relatively recently, was one of the stones selected for and initially used in the construction of the present Houses of Parliament. It is, unsurprisingly, the principal building stone used in Mansfield itself, and it features prominently in a number of the surrounding villages, particularly in churches. The impressive Minster church at Southwell, dating to the 12th century, is largely built of White Mansfield Stone (with imported Bolsover Stone), which has survived well. Although seen only rarely in the city of Nottingham, the stone is encountered with a degree of regularity elsewhere across the county, most notably in churches, where it was often the material of choice for window mouldings and other decorative work.

The characteristics of the Cadeby Formation dolostones progressively change as the outcrop is followed northwards from Mansfield Woodhouse towards Creswell. A quite dramatic change in colour, to paler shades

of yellow and grey-white, coincides with a grain size reduction and textural changes, such that in some areas these now fine to medium-grained dolostones carry vestiges of an ooidal, occasionally peloidal, and sometimes even bioclastic fabric. In the past, quarrying of the pale yellow to white Cadeby Formation dolostones was locally intensive along the Nottinghamshire–Derbyshire and Nottinghamshire–South Yorkshire county boundaries (especially on the Derbyshire and South Yorkshire sides, within which the bulk of the Cadeby Formation outcrop lies) and also to the west of Worksop, at the Steetley quarries, for example.

The parish churches in these northern and north-western parts of the county, for example at Harworth, Blyth, Scrooby and Misson, have used white and pale yellow dolostones for much of their ashlar walling and elaborate decorative stonework. These same dolostones have also migrated substantial distances eastwards in northern Nottinghamshire, in some cases to the opposite side of the county, for use in village churches at Misterton, Walkeringham, Gringley on the Hill, North Wheatley, Retford, East Drayton, Dunham-on-Trent and East Markham, for example. This quite deliberate importation was, in no small part, related to the lack of alternative more local stone types: the local Triassic bedrock was either unsuitable for building purposes or concealed by the substantial thicknesses of superficial deposits that blanket the Vale of Trent. Mention should also be made of the Church of St John the Evangelist at Carlton-in-Lindrick, which is arguably the most important building in Nottinghamshire from an architectural standpoint. Off-white and buff-coloured Magnesian Limestone ashlar features prominently in the fabric of this building, along with the rubble of a thinner bedded, distinctly more orange-coloured dolostone in its imposing Saxo-Norman tower.

Figure 8: St Mary and St Martin's Church, Blyth. Steetley Stone.

Triassic

The latest Permian and Triassic rocks of Nottinghamshire are subdivided into the sandstone-dominated Sherwood Sandstone Group (broadly equivalent to the former Bunter Sandstone) and the lithologically mixed, but nonetheless mudstone-dominated, Mercia Mudstone Group (incorporating the former Keuper Sandstone and Keuper Marls).

Sherwood Sandstone Group, Lenton Sandstone Formation, Nottingham Castle Sandstone Formation

Sherwood Sandstone

Within Nottinghamshire, the Sherwood Sandstone Group comprises the Lenton Sandstone Formation (mainly red-brown, cross-stratified, very fine to medium-grained sandstones) and the overlying Nottingham Castle Sandstone Formation (mainly pinkish-red or buff-grey, cross-bedded, medium to coarse-grained pebbly sandstones).

The sandstones of both units are generally poorly cemented and, consequently, somewhat friable, so neither has yielded any durable building stone of note. Two examples of Nottinghamshire Sherwood Sandstone are the (mostly rendered) north aisle of the Church of Holy Trinity at Everton, and possibly the north transept of the Church of St Swithun at Retford. The characteristics of the Nottinghamshire Sherwood Sandstone have been exploited in other ways historically, however, notably by providing a soft medium that could be readily excavated to provide caves for both occupation and storage. The extensive network of caves within the Nottingham Castle Sandstone underlying Nottingham city centre provides a classic example.

In the south-west of the county, essentially fine-grained, cross-bedded sandstones in various shades of pale grey, green and brown occur within the fabrics of a number of the village churches, including those at Sutton Bonington, Normanton-on-Soar, Gotham and Ratcliffe-on-Soar, as well as the chancel of the Church of St Mary at Attenborough. These particular sandstones are believed to have originated from the former quarries within the Bromsgrove Sandstone Formation outcrops (previously mapped as Keuper Sandstone) at Kegworth and Castle Donington in Leicestershire and at Weston-on-Trent in Derbyshire. Sandstones of this type also feature to some extent in bridges and dwelling houses in south-west Nottinghamshire, and are believed to have similar origins to those seen in the churches mentioned above.

Mercia Mudstone Group, Tarporley Siltstone Formation

Waterstones Sandstone (Keuper Sandstone)

The Sherwood Sandstone Group in most areas gives way by gradually fining upwards to the overwhelmingly mudstone-dominated Mercia Mudstone Group. Around Nottingham, however, the change is abrupt and marked by

an unconformity, above which lies a patchily distributed conglomerate of up to 1m in thickness. In both cases, the transition represents the lower boundary of the Tarporley Siltstone Formation. This heterolithic unit, formerly referred to as the (Keuper) Waterstones, comprises interlaminated and interbedded siltstones, mudstones and sandstones in approximately equal proportions. The sandstones are mostly very fine to fine grained, well sorted and micaceous. They are pale reddish-brown or grey-brown in colour, although green-grey mottles and laminae are common. Waterstones Sandstone was quite widely quarried historically, and it has been used for building purposes within central Nottinghamshire, especially within (but not restricted to) a triangular area defined by northern Nottingham (Carlton and Arnold), Southwell and Ollerton. The sandstones feature in churches with medieval origins, such as those at Gedling, Arnold, Woodborough, Lowdham, Epperstone and Edingley.

Waterstones Sandstone also saw use in non-ecclesiastical buildings located in and around Edingley and Halam, including Ashbourne House and Littledale Cottage, and boundary and retaining walls at Woodborough and Epperstone, for example. The river front curtain wall of Newark Castle is another example of the use of Waterstones Sandstone, although it is uncertain as to which build phase or restoration episode this belongs to.

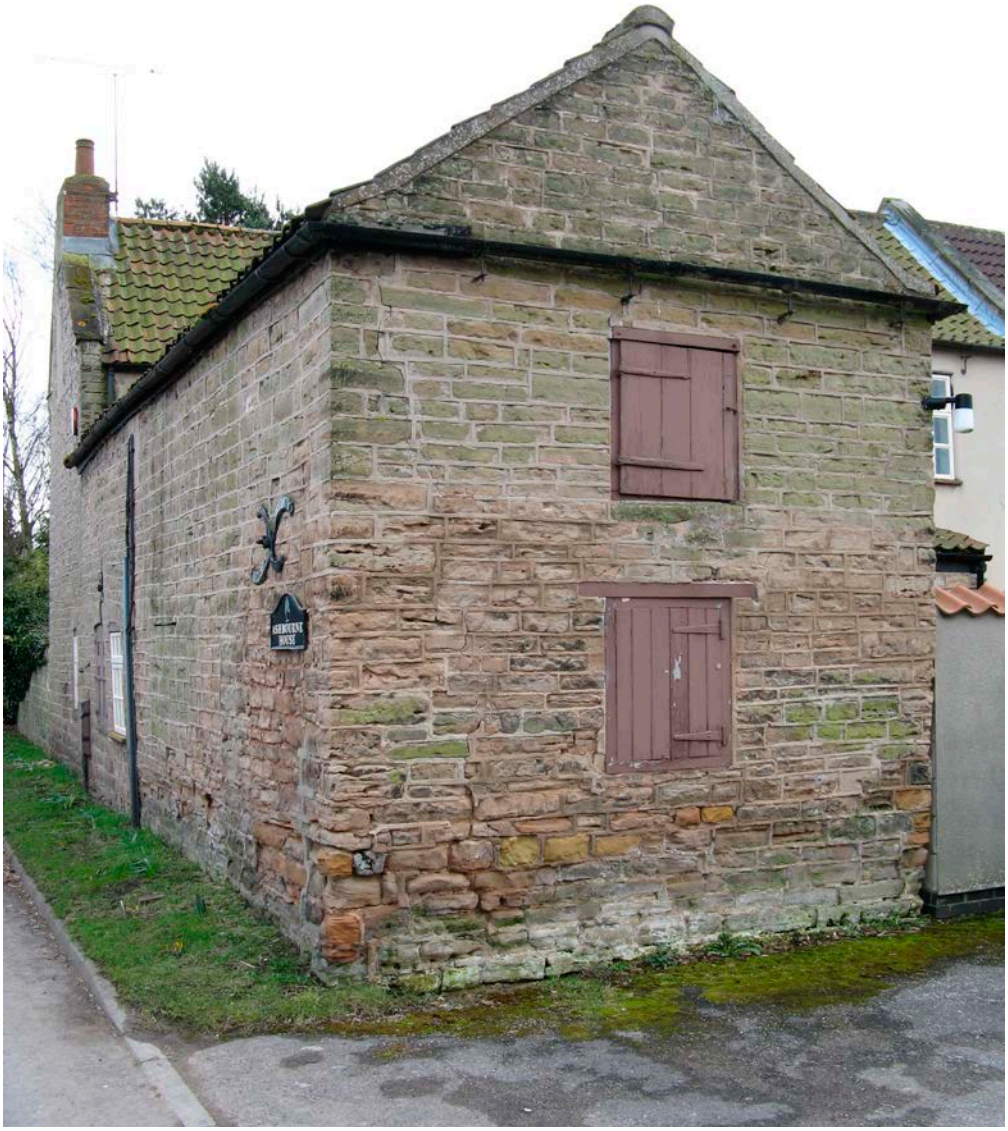


Figure 9: Asbourne House, Edingley. Waterstones Sandstone.

Figure 10: St Peter and St Paul's Church, Shelford. Waterstones Sandstone.

Mercia Mudstone Group, Sidmouth Mudstone Formation, Arden Sandstone Formation, Branscombe Mudstone Formation

Skerry Sandstone (Skerries)

The Tarporley Siltstone Formation, or the Sherwood Sandstone Group in areas where the Tarporley Siltstone is either absent or not differentiated, is comformably succeeded by the Sidmouth Mudstone Formation. This, in turn, is succeeded by the Arden Sandstone Formation and then the Branscombe Mudstone Formation. It should be noted, however, that in the area to the north of Newark and Southwell, no such distinction currently exists and the stratigraphic interval between the top of the Tarporley Siltstone and the base of the (Rhaetian) Penarth Group is mapped as undifferentiated Mercia Mudstone Group.

Irrespective of this nomenclature-related issue, the Mercia Mudstone Group strata sitting above the level of the Tarporley Siltstone locally carry heterolithic units, comprising horizons of grey-green dolomitic siltstone and very fine-grained sandstone interbedded with mudstone. The hard siltstone and fine sandstone beds, which often display spectacular soft sediment deformation features, are known as Skerry Sandstones or simply ‘Skerries’ across the East Midlands. Historically, they were commonly quarried for building and walling stone in the areas within which they occur, quite frequently from transient workings of which there is now little or no evidence in the landscape. This practice is known to date back to Roman times.

Relatively large-scale quarrying operations are known to have existed at East Markham, Tuxford, Egmanton, Laxton, Kneesall, Maplebeck and Hockerton, where the Skerries are distinctly thicker bedded.

The Skerry Sandstone horizons occurring to the south-east of the River Trent tend to be thinly bedded, yielding a slab-like rubblestone. These thin-bedded Skerry blocks feature in villages, especially in churches, that are underlain by the arcuate outcrop of the Mercia Mudstone that runs from Cotgrave, through Bingham and East Bridgford, to Elston. Use of the Skerry was not restricted to churches, however, and it is seen within the fabrics of dwelling houses and farm buildings, as well as in boundary walling. Flintham, Sibthorpe and Hawksworth serve as good examples of villages in which thin-bedded Skerry can be seen more generally. In the north of the county, on the eastern side of the Mercia Mudstone Group outcrop, thin-bedded Skerry Sandstone is again encountered locally. Examples include the Church of St Martin at Bole, the Church of SS Peter and Paul at Sturton-le-Steeple and, most noteworthy of all, the well-preserved Norman Church of St Nicholas at Littleborough.

Figure 11: Warrener's Cottage, Thurgarton. Skerry Sandstone.

Figure 12: St Nicholas' Church, Littleborough. Skerry Sandstone.

Within the Skerry belt to the north-west of Newark, it is common to find sizeable blocks of Skerry Sandstone featuring prominently in the village churches. Those at Maplebeck, Moorhouse, Norwell and Tuxford serve as good examples. Thick-bedded Skerry Sandstone is also encountered further east and south-east, again in churches, such as those at East Drayton, Fledborough, Sutton-on-Trent, North Muskham, South Muskham, Kelham, East Stoke and Gonalston.

Figure 13: Trent Bridge, Newark. Skerry Sandstone.

Gypsum and Alabaster

Also present in the Mercia Mudstone Group are beds of gypsum (hydrated calcium sulphate). These were, and in some cases still are, extensively quarried or mined at East Bridgford, Cropwell Bishop, Newark, Redhill and Gotham. Gypsum is still employed to produce plaster of Paris, and in earlier times it was used with other aggregates such as crushed brick to create floors for the upper storeys of houses. In medieval and later times, the Mercia Mudstone beds provided a finer grained variety of gypsum which supported a major alabaster carving industry in Nottinghamshire, with mines near Newark and just outside the county at Chellaston in Derbyshire.

Figure 14: Tomb effigies, St Mary the Virgin, Clifton. Alabaster.

Lower Jurassic

Lias Group, Scunthorpe Mudstone Formation

Lias

Lias Group strata crop out to a limited extent in eastern and south-eastern Nottinghamshire. At low stratigraphic levels within this succession are the interbedded blue-grey mudstones and blocky limestones of the Barnstone Member (latest Triassic to earliest Jurassic in age).

These have been widely quarried for centuries and used in vernacular and ecclesiastical buildings, and also for general walling, in the areas surrounding their outcrop. Evidence of Lias use dating back some 1,000 years is provided by the ruins of Newark Castle, the Norman parts of which prominently feature this stone type.

Figure 15: Newark Castle gatehouse. Lias.

Figure 16: The Friary, Newark. Lias.

Churches of various ages built mainly or partly of Lias are found within an arcuate band, running roughly parallel to the Nottinghamshire–Leicestershire and then the Nottinghamshire–Lincolnshire county boundaries, between Wysall in the south and Hawton further north and east. The limestone again features along the Trent Valley to the north of Newark and is seen, to a greater or lesser extent, in the churches of St Wilfrid at South Muskham, St Wilfrid at North Muskham, All Saints and St John the Baptist at Collingham, All Saints at Sutton-on-Trent and St Cecilia at Girton, among others. Within Newark, Lias was used in the 17th, 18th and 19th centuries for the friary, for dwelling houses (for example, The Chestnuts on North Gate) and for the offices at at Castle Brewery.

Elsewhere, in locations relatively removed from the outcrop, the limestone was put to decorative use during Victorian times, for example in the walling of St Andrew's Church at Nottingham, St Peter's Church at East Bridgford and St Mary's Church at Radcliffe-on-Trent.

Lias Group, Marlstone Rock Formation

Marlstone Rock

Higher up the Lias Group succession, a distinctive unit comprising sandy, bioclastic and ooidal, ferruginous limestones and ferruginous calcareous sandstones is present. These orange-brown 'ironstone' lithologies, which are assigned to the Marlstone Rock Formation, do not actually crop out within Nottinghamshire, but occur only a short distance to the south-east of the county within the Vale of Belvoir. Nonetheless, they warrant mention because they appear sporadically in a variety of buildings located in the extreme east and south-east of Nottinghamshire, including the Church of All Saints, farm outbuildings and cottages at Granby, the Church of St Margaret at Owthorpe, the Church of St Luke at Hickling and Elston (Old) Chapel. The limestone, in particular, is an attractive stone, but it is generally soft and frequently highly fossiliferous, so tends to weather rather badly.

Figure 17: Church of St Margaret, Owthorpe. Marlstone Rock.

Quaternary

Various groups, various formations

Boulders, cobbles and tufa

Much of Nottinghamshire is mantled by a thin covering of Quaternary glacial, fluvo-glacial and alluvial clays, sands and gravels. These variably carry boulders and cobbles of hard, resistant lithologies (typically well-cemented quartzitic sandstones), which have occasionally been utilised for walling purposes, either as part of the original fabric or as replacement inserts. Boulders are conspicuous in the walling of the Church of All Saints at Stanton-on-the-Wolds and are also seen in the south aisle and tower of the Church of St Mary at Plumtree, as well as at Holy Trinity Church, Everton, and Holy Trinity Church, Wysall.

To the north-west of Newark, patches of tufa locally occupy the alluvial fills of certain small streams draining eastwards off the Mercia Mudstone. These tufas appear to have developed close to spring lines associated with horizons of Skerry Sandstone (the likely source of the lime), and the larger outcrops occur near Caunton, Maplebeck, Moorhouse, Weston and Darlton.

The material itself comprises microcrystalline to cryptocrystalline calcite, with a little fine quartz and cryptocrystalline silica. It is very porous and riddled with the impressions of reeds and other plants. Perhaps surprisingly, the tufa has been used successfully as a walling stone, and it is seen in All Saints' Church at Weston, St Andrew's Church at Caunton and St Laurence's Church at Norwell, for example.

Figure 18: Church of St Mary, Plumtree. Quaternary boulders.

3 Examples of Imported Building Stones

The stone-built architecture of Nottinghamshire has benefited considerably from the close proximity of several important quarrying centres within the adjacent counties.

Carboniferous sandstones, Derbyshire

Derbyshire, in particular, one of the UK's most important producers of Carboniferous building sandstones, whether from the Millstone Grit or the Pennine Coal Measures successions, has long supplied Nottinghamshire with high-quality dimension stone. In Nottingham, the majestic Cathedral Church of St Barnabas, designed by the Victorian architect Augustus Pugin, is but one of many structures that have used imported Derbyshire-quarried sandstone (in this case, Millstone Grit from Darley Dale).

Further examples include the former head office of the Nottingham and Nottinghamshire Bank on Thurland Street (by Watson Fothergill; also using Darley Dale sandstone), The Guildhall (Sydnope Stone) and a number of the other office and administrative buildings in Nottingham city centre, such as the late 20th-century Crown Court buildings. The coarse-grained sandstones used for the extensive restoration and rebuilding works carried out on the Church of St John the Baptist at Beeston, the Church of St Helen at Trowell and the Church of St Catherine at Cossall (all of which, seemingly, had local Coal Measures Sandstone fabrics originally) were also likely sourced from Derbyshire, and originated more specifically from within the Millstone Grit succession of the county.

Several much earlier and more intriguing examples of the use of imported Millstone Grit are provided by the substantial medieval towers of St Mary's Church at Bunny, St Mary Magdalene's Church at Keyworth, All Saints' Church at Cotgrave, St Giles' Church at West Bridgford and Holy Trinity Church at Rolleston. Both the exact origins of this stone and the rationale behind its use remain uncertain at the present time.

Figure 19: Holy Trinity Church, Rolleston. Millstone Grit.

Magnesian Limestone, Derbyshire and South Yorkshire

The Cadeby Formation quarries of Derbyshire (such as Steetley and Whitwell) and South Yorkshire (such as Roche Abbey), as previously observed, have supplied Magnesian Limestone since medieval times to the full breadth of northern Nottinghamshire for use in the construction of churches.

Lincolnshire Limestone, Lincolnshire

To the east, within Lincolnshire, lie the renowned (Middle Jurassic) Lincolnshire Limestone freestone quarries at Ancaster, Heydour and Clipsham. Along with numerous other smaller quarries, these have, for centuries, supplied Nottinghamshire with substantial quantities of high-quality, buff-coloured, ooidal and bioclastic limestone for building purposes. The import of stone from the Ancaster area specifically dates back to at least medieval times, evidenced by the grand 12th to 15th-century Church of St Mary Magdalene in the centre of Newark. This must surely have presented considerable logistical challenges to its builders. Further evidence of the determined pursuit and early use of Ancaster Stone is provided by the 14th-century chancel of the Church of All Saints at Hawton.

The limestones of the Lincolnshire Limestone Formation, generally, are well displayed in churches across Nottinghamshire, having been particularly favoured (especially for dressings) during the widespread restoration and rebuilding works carried out in Victorian times. It is particularly common to see Lincolnshire Limestone used in conjunction with Lias, a pairing that is not restricted to churches. Among the non-ecclesiastical Lincolnshire Limestone buildings of Nottinghamshire, the pre-eminent example is the Elizabethan Wollaton Hall, located a short distance to the west of Nottingham city centre. Built entirely of Ancaster Stone between 1580 and

1588 for Sir Francis Willoughby, this must have proved to be a costly and challenging exercise. Lincolnshire Limestone features prominently in various other buildings and structures across the county, such as the HSBC (formerly the Midland) Bank in Market Place, Newark, the buttercross in Bingham, Newark Castle station and some of the original university buildings (such as the Arkwright Building) in the centre of Nottingham.

Figure 20: Wollaton Hall. Lincolnshire Limestone.

Intrusive igneous rocks, Charnwood Forest, Leicestershire

Other imported stone types that have local significance in Nottinghamshire, most notably in southern parts of the county, include the intrusive igneous rocks of the Charnwood Forest area. These include the pink (Ordovician) Mountsorrel Granodiorite and the green-grey (Neoproterozoic) Groby Diorite, as well as the dark green and purple low-grade metamorphic slates of early Cambrian age produced by the Swithland and Groby quarries. These lithologies have been used variously for both roofing and walling stone and, in the case of the intrusive igneous types, for kerb stones and setts.

Other stone types: Portland Limestone, Dorset, Runcorn Sandstone, Cheshire, Carboniferous limestones, Derbyshire

Occasionally, more prestigious stone types from even further afield were imported into the county for use in public and other high-status buildings. These include the Portland Limestone (of uppermost Jurassic age) used for the Council House and Newton Building in Nottingham city centre and the University of Nottingham's Trent Building.

The Duke of Newcastle, meanwhile, specifically brought in red-brown Runcorn Sandstone (of early to mid-Triassic age) for his church at Clumber Park. By the time these buildings were erected in the 19th and 20th centuries, the well-developed state of the transport network, especially the rail and inland waterway networks, facilitated relatively easy access to these stones.

The more proximal Carboniferous limestones of Derbyshire have seen widespread decorative use in Nottinghamshire churches, including St Mary Magdalene's Church at Nottingham, and also in the foyers of several of the 'new' buildings on the University of Nottingham campus.

Figure 21: Trent Building, University of Nottingham. Portland Limestone facade.

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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