

# STRATEGIC STONE STUDY

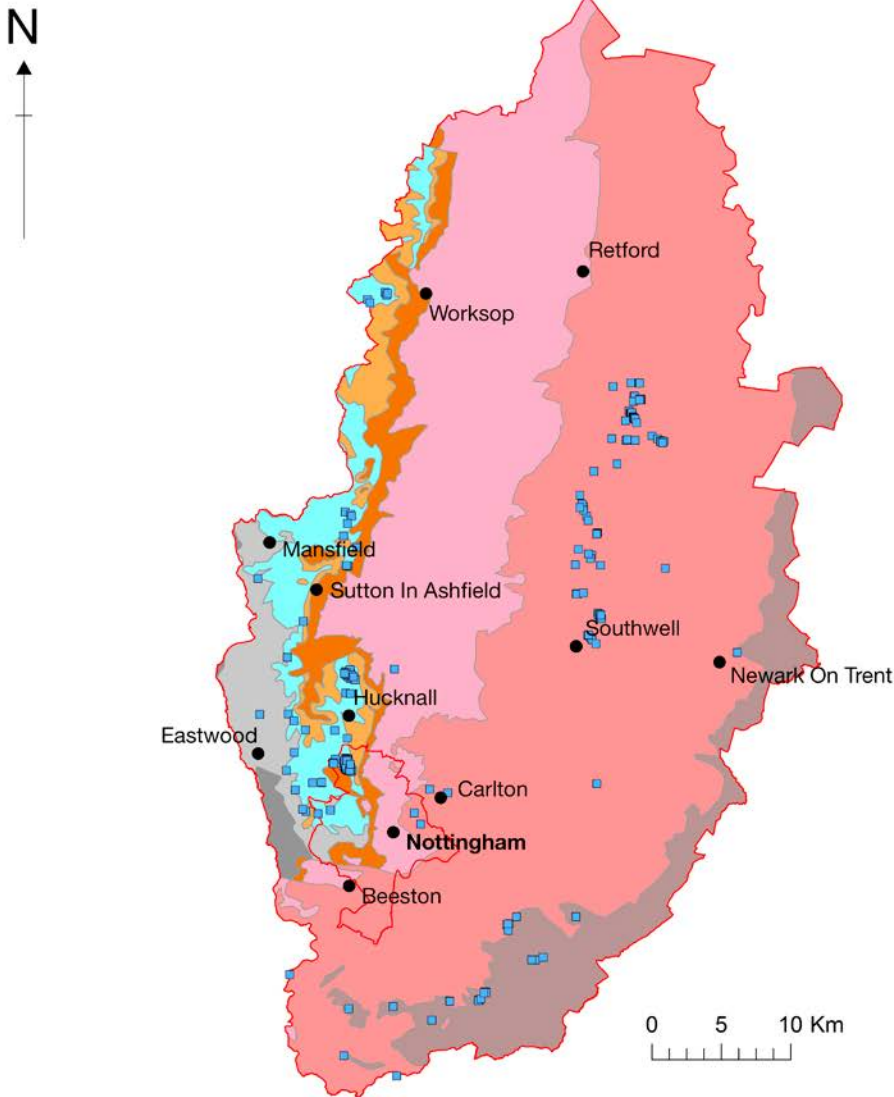
A Building Stone Atlas of  
NOTTINGHAMSHIRE

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# Nottinghamshire Bedrock Geology



## Nottinghamshire Bedrock Geology

■ 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
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	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)

Click on this link to explore the geology of Nottinghamshire and the area's known building stones, stone structures and building stone quarries (opens in new window <http://maps.bgs.ac.uk/buildingstone?County=Nottinghamshire>)

## 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. Though not generally considered to be a 'stone county', any study of Nottinghamshire's 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 their sites of final use. Brick is by far the dominant building material seen in the county, and local brick production dates back to at least the early C16 (evidenced, for example, by the surviving south range of Holme Pierrepont Hall). The use of stone for building purposes goes back considerably further, however, in some areas to Roman times. The Roman township of Margidunum, for example, situated adjacent to the Fosse Way between modern day East Bridgford and Bingham, utilized 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 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 railway networks during the mid-C19. This led to the introduction of materials sourced from beyond the county, and these 'imported' stone types are particularly well seen 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 which collectively dip gently eastwards and give rise to an overall NNE–SSW trending outcrop pattern (see facing geological map), 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.

# CARBONIFEROUS

## Pennine Coal Measures Group

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 owing to its constituent coal seams, but it also contains a number of hard sandstone beds, which have been quarried fairly extensively for local building stone in the Nottinghamshire–Derbyshire area (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 most iconic building – its Castle, which is in fact a subsequently remodelled late C17 mansion

(and now the Castle Museum and Art Gallery) – is not precisely known, but it is believed to have originated from quarries in the Trowell district. Certain older houses and churches in the Selston–Brinsley–Greasley–Cossall area feature local Coal Measures sandstones in their fabrics, as indeed do buildings and boundary walls in and around Trowell and Wollaton (e.g. the Church of St. Leonard 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, and 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



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'The Chantry', a cottage located in Wollaton and dating to c.1500, is constructed of large squared blocks of Carboniferous Coal Measures Sandstone.



often not a straightforward matter. 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 in Wilford, for example, is constructed of Coal Measures Sandstone.



The Coal Measures Sandstone walling of the south aisle of the Church of St. Helen, Trowell is highly ferruginous, being seen to contain clasts as well as discrete bands of ironstone.

## PERMIAN

### Zechstein Group

### Cadeby Formation

### (Lower) Magnesian Limestone

The Late Permian Zechstein Group succession fringing much of western Nottinghamshire is subdivided into a variably sandy lower unit of dolostones or dolomitic limestones (i.e. the Cadeby Formation) and an upper unit comprising mainly red mudstones (often termed 'marls') and sandstones (i.e. the Edlington Formation). The Cadeby Formation, formerly known as the 'Lower Magnesian Limestone', is the source of the county's best known building stones. This unit 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 Bulwell- and Linby-produced stones are highly distinctive yellow-brown to orange coloured, coarsely crystalline dolostones (often mistaken for sandstones), both of which were widely used in the past for housing, churches, schools and factories. Many of the C19 and early C20 suburban developments of Nottingham (e.g. West Bridgford) have boundary walls constructed of rock-faced blocks of Bulwell Stone. The use of Bulwell Stone *per se* is documented as far back as the C16, but it is not in active production present day.

The Linby quarries, having supplied stone for nearby Newstead Abbey in medieval times, are still operating today (albeit on a limited scale), and recently supplied stone for the flood defence walls along the River Trent at Wilford and also 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 (St. Mary Magdalene's), several cottages and terraced streets. The stone also features prominently in the older buildings of Papplewick and of Linby itself. The generally thinly bedded nature of both the Bulwell and Linby stones compromises their use as a **FREESTONE**, however, with the result that other **LIMESTONES** (*sensu stricto* and *sensu lato*) from the Cadeby Formation and the Middle Jurassic Lincolnshire Limestone Formation have been employed for mouldings and other decorative work across the county.



Locally quarried Linby Stone dominates the fabric of both the medieval and Victorian parts of the Church of St. Mary Magdalene in Hucknall.

Further north at Mansfield, the Cadeby Formation has yielded two dolostone varieties known as the 'Mansfield Red' and 'Mansfield White' stones. Of contrasting colour, as their names would 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 C19, and the 'Red' variety (long worked out), was popular for decorative work both locally (e.g. The Shire Hall, now Galleries of Justice, in Nottingham city centre, Kelham Hall near Newark, and in numerous shop fronts across the county) as well as nationally (e.g. the former Midland Grand Hotel, now St. Pancras Renaissance Hotel, in Central London). 'Mansfield White', which was still quarried until relatively recently, was one of the stones selected for and initially used (in 1839) in the construction of the present Houses of Parliament. It is unsurprisingly the principal building stone used in Mansfield itself, and it features prominently, particularly in churches, in a number of the surrounding villages. The impressive Minster church at Southwell, dating to the C12, is also largely built of 'Mansfield White' (plus imported 'Bolsover Stone'), which has survived well in an effectively rural location such as this. 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, it frequently having been a 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. Quarrying of the pale yellow to white Cadeby Formation dolostones was locally intensive in the past along the

Southwell Minster, having C12 origins, is largely constructed of 'Mansfield White' and (imported) Bolsover Stone, both varieties of Magnesian Limestone.



© Graham Lott

Imposing half-columns of 'Mansfield Red' Magnesian Limestone flank the entrance of the Shire Hall, now the Galleries of Justice, in Nottingham city centre.



© Paul Witney

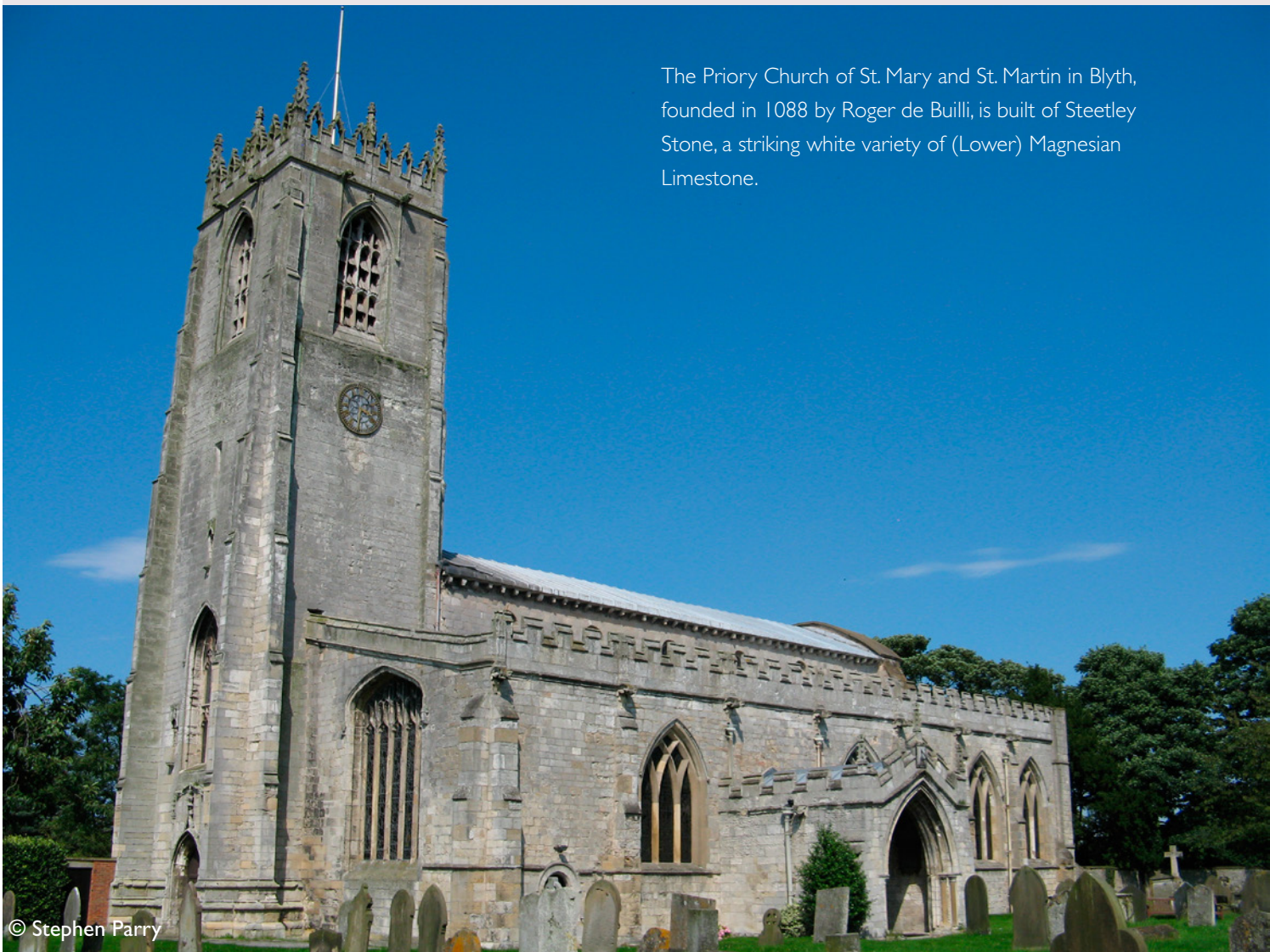


Nottinghamshire–Derbyshire and Nottinghamshire–South Yorkshire county boundaries (especially on the Derbyshire and South Yorkshire sides, within which the bulk of the Cadeby Formation outcrop lies) and also to the west of Worksop (e.g. the Steetley quarries). The parish churches in these northern and northwestern parts of the county, for example those at Harworth, Blyth, Scrooby and Misson, have used such white and pale yellow dolostones for much of their **ASHLAR** walling and often 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 (e.g. Misterton, Wakeringham, Gringley on the Hill, North Wheatley, Retford, East Drayton, Dunham on Trent and East Markham). This quite deliberate importation was in no small part related to the lack of alternative more local stone types, the local Triassic bedrock being 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 in 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.

## TRIASSIC

The latest Permian and Triassic rocks of Nottinghamshire are sub-divided 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'). The



The Priory Church of St. Mary and St. Martin in Blyth, founded in 1088 by Roger de Builli, is built of Steetley Stone, a striking white variety of (Lower) Magnesian Limestone.

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latter, but not the former, is important from a building stones standpoint.

## Sherwood Sandstone Group

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, with the result that neither has yielded any durable building stone of note. Nottinghamshire-sourced Sherwood Sandstone has only been seen with certainty during the present study in the (mostly rendered) north aisle of the Church of Holy Trinity in Everton and possibly within the north transept of the Church of St. Swithun in 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 the 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; those at Sutton Bonington, Normanton on Soar, Gotham, Ratcliffe on Soar and the chancel of the Church of St. Mary in Attenborough serve as prime examples. These particular sandstones are believed to have originated from the former quarries within the Bromsgrove Sandstone Formation outcrops (although 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.

Variegated 'Waterstones Sandstone', likely originating from the Gedling-Sneinton area of modern-day Nottingham, forms much of the Church of St. Peter and St. Paul in Shelford.

# MERCIA MUDSTONE GROUP

## Tarporley Siltstone Formation

### 'Waterstones Sandstone'

The Sherwood Sandstone Group in most areas gives way by upwards fining gradation 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, though green-grey mottles and laminae are common. These 'Waterstones Sandstones' were quite widely quarried historically, and have been used for building purposes within central Nottinghamshire, especially within (but certainly not restricted to) a triangular area defined by northern Nottingham (Carlton and Arnold), Southwell and Ollerton. They 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 (e.g. Ashbourne House and the Grade II-listed Littledale Cottage) as well as for boundary and retaining walls (e.g. Woodborough and Epperstone). One further example



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of the use of 'Waterstones Sandstone' is provided by the river front curtain wall of Newark Castle, although it is uncertain as to which build phase or restoration episode this belongs to.



© Stephen Parry  
Asbourne House on Main Street, Edingley incorporates what may be a C17 coach house/stables, which is constructed of 'Waterstones Sandstone'.

### *Sidmouth Mudstone and Branscombe Mudstone formations*

#### **Skerry Sandstone**

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 (covered by 1:50 000 Sheet 113), 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. They were commonly quarried historically 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, Eglington, Laxton, Kneesall, Maplebeck and Hockerton, where the Skerries are distinctly thicker-bedded.



© Stephen Parry  
The Norman Church of St. Nicholas in Littleborough boasts extensive herringbone masonry of thinly bedded Skerry Sandstone.



© Stephen Parry  
Use of 'thick-bedded' Skerry Sandstone was not restricted to churches, as is evidenced by various buildings, including Warrener's Cottage, in Thurgarton.





Skerry Sandstone, apparently from Maplebeck, features prominently in the pilasters and arches of the Trent Bridge in Newark.

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 their 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 just 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 locally encountered e.g. in the churches at Bole, Sturton le Steeple and, most noteworthy of all, the well preserved Norman Church of St. Nicholas in Littleborough.

Within the 'Skerry belt' located 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.

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. The gypsum was, and still is, used to produce 'plaster of Paris', and in earlier times was used along with reeds to create flooring surfaces ('plaster floors') for the upper storeys of houses. In medieval and later times, the gypsum beds of the Mercia Mudstone supported a major alabaster-carving industry in Nottinghamshire, although the supplying mines lay just outside the county at Chellaston in Derbyshire.



The clays of the Mercia Mudstone Group have always been Nottinghamshire's principal source of clay for brick and tile manufacture. Major brick-producing centres were set up in the Mapperley, Carlton, Arnold, Ludlow Hill (West Bridgford) and Wilford areas, and also at several villages along the outcrop (e.g. Ruddington, Bingham, East Bridgford, Lowdham, Kirton, Gringley on the Hill and Walkeringham).

## LOWER JURASSIC

### Lias Group

#### *Scunthorpe Mudstone Formation*

#### Lias Limestone

Lias Group strata crop out to a limited extent in eastern and southeastern Nottinghamshire. At low stratigraphic levels within this succession occur 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 Limestone' use dating back some 1000 years is provided by the ruins of Newark Castle, the Norman parts of which prominently feature this stone type. Churches of various ages built mainly or partly of Lias Limestone 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. Lias Limestone again features along the Trent Valley to the north of Newark, being seen to a greater or lesser extent in the churches at South Muskham (St. Wilfrid's), North Muskham (also St. Wilfrid's), Collingham (All Saints' and St. John the Baptist's), Sutton on Trent (All Saint's) and Girton (St. Cecilia's) amongst others. Within Newark, Lias Limestone was used in the C17, C18 and C19 for The Friary, for dwelling houses (e.g. The Chestnuts on Bar Gate) and for the Castle Brewery Offices. Elsewhere, in locations relatively removed from the outcrop, Lias Limestone was put to decorative use during Victorian times, for example in the walling of



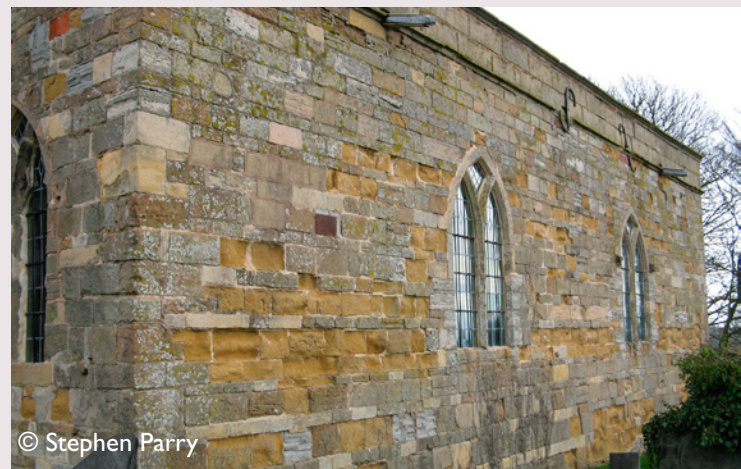
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Amongst the few stone buildings present in Newark, The Friary (comprising C17, C18 and C19 parts) is another example of one constructed largely of blue-grey Lias Limestone.



© Stephen Parry

Lias Limestone rubble is a major component of the walling of the surviving Norman parts of Newark Castle, such as its gatehouse.



© Stephen Parry

Cavitating orange-brown blocks of Marlstone Rock are conspicuous along the south side of the Church of St. Margaret in Owthorpe.

churches located in Nottingham (St. Andrew's), East Bridgford (St. Peter's) and Radcliffe on Trent (St. Mary's).

## 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 do occur only a short distance to the south-east of the county within the Vale of Belvoir. They nonetheless warrant mention as they appear sporadically in a variety of buildings located in the extreme east and south-east of Nottinghamshire e.g. Granby (the Church of All Saints, farm outbuildings and cottages), Owthorpe (the Church of St. Margaret), Hickling (the Church of St. Luke) and Elston (Elston (Old) Chapel). The limestone especially is an attractive stone, but it is generally soft and frequently highly fossiliferous and tends to weather rather badly.

## PLEISTOCENE

Much of Nottinghamshire is mantled by a thin covering of Quaternary glacial, glacio-fluvial 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 utilized 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 in Stanton on the Wolds, and are also seen in the south aisle and tower of the Church of St. Mary in Plumtree, as well as at Everton (Church of Holy Trinity) and at Wysall (Church of Holy Trinity).

To the NW of Newark, patches of calcareous 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, Mapleback, Moorhouse, Weston and Darlton. The material itself comprises **MICROCRYSTALLINE** to **CRYPTOCRYSTALLINE** calcite with a little fine quartz and cryptocrystalline silica, and is



The Church of St. Mary the Virgin in Plumtree has Saxo-Norman origins and features locally gathered, reddened boulders of well-cemented quartzitic sandstone in both its tower and south aisle.

very porous, being riddled with the impressions of reeds and other plants. Perhaps surprisingly, the tufa has been used successfully as a walling stone, and is seen in the churches at Weston (All Saints'), Caunton (St. Andrew's) and Norwell (St. Laurence's), for example.

## IMPORTED BUILDING STONES

The stone-built architecture of Nottinghamshire has benefited considerably from the close proximity of several important quarrying centres lying within the adjacent counties. Derbyshire, in particular, one of the UK's most important producers of Carboniferous building sandstones – whether from the Millstone Grit or Pennine Coal Measures successions – has long supplied



Nottinghamshire with high quality dimension stone. The majestic 1841–44 Cathedral Church of St. Barnabus, designed by the famous Victorian architect Augustus Pugin, serves as one example of the many structures which have utilized imported Derbyshire-quarried sandstone (in this case, Millstone Grit from Darley Dale). Further examples are provided by the former Head Office of the Nottingham & Nottinghamshire Bank Co. on Thurland Street (1877–82 by Watson Fothergill; also using Darley Dale sandstone), The Guildhall (1887–88; of Sydnope Stone) and a number of the other office and administrative buildings in Nottingham city centre (e.g. the late C20 Crown Court buildings). The coarse-grained sandstone(s) used for the extensive restoration and rebuilding works carried out on the Church of St. John the Baptist in Beeston and the churches at Trowell and 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 the churches at Bunny (St. Mary's), Keyworth (St. Mary Magdalene's), Cotgrave (All Saints'), West Bridgford (St Giles') and Rolleston (Holy Trinity). Both the exact origins of this stone and the rationale behind its use remain uncertain at the present time.

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

To the east, within Lincolnshire, lie the renowned (Middle Jurassic) Lincolnshire Limestone freestone quarries at Ancaster, Heydour and Clipsham. These, along with numerous other smaller quarries, 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 C12–C15 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 C14 chancel of the Church of All Saints in 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 during Victorian times. It is particularly common to see Lincolnshire Limestone used in conjunction with Lias Limestone (a pairing which is not just restricted to churches). Amongst 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 again have proved to be a costly and challenging exercise. Lincolnshire Limestone also features prominently in various other buildings and structures across the county such as the HSBC (formerly the Midland) Bank in Newark, The Buttercross in Bingham, Newark Castle Station and the original University buildings (such as the Arkwright Building) in the centre of Nottingham.

Other imported stone types which have some local significance in Nottinghamshire, most notably in southern parts of the county, include the intrusive igneous



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The massive C12 and C14, four-stage tower of the Church of Holy Trinity in Rolleston is constructed of pale Millstone Grit, which was quite clearly not quarried locally.

rocks of the Charnwood Forest area such as the pink (Ordovician) Mountsorrel Granodiorite and the green-grey (Neoproterozoic) Groby Diorite, and also the dark green and purple low-grade metamorphic slates of early Cambrian age produced by the Swithland and Groby quarries. These lithologies have variously been used both for roofing and walling stone and, in the case of the intrusive igneous types, for kerbstones and setts, which have travelled greater distances to the likes of Nottingham and Newark.

Occasionally, more prestigious stone types from even further afield were imported into the county for use in public and other 'high status' buildings e.g. the Portland Limestone (of uppermost Jurassic age) used for the Council House and Newton Building in Nottingham city centre and also 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. The well-developed state of the transport network, especially the rail and inland waterway networks, by the time these buildings were erected in the C19 and C20 facilitated relatively easy access to these stones.



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The late C16 Wollaton Hall, located a short distance to the west of Nottingham city centre, is built entirely of Lincolnshire Limestone from the Ancaster quarrying area lying between Grantham and Sleaford.

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

The Trent Building, on the University of Nottingham's main campus, is faced with uppermost Jurassic Portland Limestone imported into the city from Dorset.



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# Glossary

**Alluvial:** A term referring to the environments, action and products of rivers and streams.

**Ashlar:** Stone masonry comprising blocks with carefully worked beds and joints, finely jointed (generally under 6mm) and set in horizontal courses. The blocks within each course are of the same height, though successive courses may be of different heights. 'Ashlar' is often wrongly used as a synonym for facing stone.

**Bioclastic:** Applied to a limestone containing the fragmental debris of calcareous organisms.

**Calcareous:** A rock which contains significant (10–50%) calcium carbonate, principally in the form of a cement or matrix.

**Clast:** A fragment of pre-existing rock or part-lithified sediment.

**Cross-bedding:** A feature principally of sandstones reflecting the movement of sand grains in currents, often producing a layering oblique to the margins of the beds.

**Cryptocrystalline:** Referring to a crystalline material, the constituent crystals of which are not optically resolvable.

**Dolomitic/dolomitized limestone, dolostone:** Terms applied to limestones that have had some or all of their constituent calcium carbonate replaced by dolomite (calcium magnesium carbonate).

**Dressings:** To say a building is constructed of brick with stone dressings means that worked stone frames the corners and openings of the structure.

**Ferruginous:** Containing iron minerals usually in the form of an iron oxide, which gives the rock a 'rusty' stain.

**Freestone:** Term used by masons to describe a rock that can be cut and shaped in any direction without splitting or failing.

**Glacio-fluvial:** A term referring to the sediments or landforms produced by meltwater discharge from a glacier.

**Heterolithic:** Comprising a variety of lithological types.

**Ironstone:** A sedimentary rock composed of more than 50% iron-bearing minerals.

**Limestone:** A sedimentary rock consisting mainly of calcium carbonate ( $\text{CaCO}_3$ ) grains such as ooids, shell and coral fragments and lime mud. Often highly fossiliferous.

**Lithology:** The description of a rock based on its mineralogical composition and grain-size e.g. sandstone, limestone, mudstone etc.

**Micaceous:** Applied to a rock which contains a significant proportion of mica, usually muscovite and/or biotite.

**Microcrystalline:** Referring to a crystalline material, the constituent crystals of which can be seen only with a microscope.

**Mudstone:** A fine-grained sedimentary rock composed of a mixture of clay and silt-sized particles.

**Ooidal:** Descriptive term indicating the presence of ooids (typically spheroidal grains of calcium carbonate formed by the precipitation – by algae – of calcium carbonate in concentric layers).

**Peloidal:** Descriptive term indicating the presence of peloids (grains of micritic carbonate of non-specific shape, size or origin).

**Rubble:** Rough, undressed or roughly dressed building stones typically laid uncoursed (random rubble) or brought to courses at intervals. In squared rubble, the stones are dressed roughly square, and typically laid in courses (coursed squared rubble).

**Sandstone:** A sedimentary rock composed of sand-sized grains (i.e. generally visible to the eye, but less than 2 mm in size).

**Siltstone:** A sedimentary rock composed of silt-sized grains (i.e. only just visible to the eye).

**Stratigraphy:** Branch of geoscience dealing with stratified rocks (generally of sedimentary origin) in terms of time and space, and their organisation into distinctive, generally mappable units.

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This study, written by Drs Stephen Parry and Graham Lott of the British Geological Survey, is Nottinghamshire's contribution to the Strategic Stone Study, sponsored by English Heritage and Nottinghamshire County Council.

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