

# STRATEGIC STONE STUDY

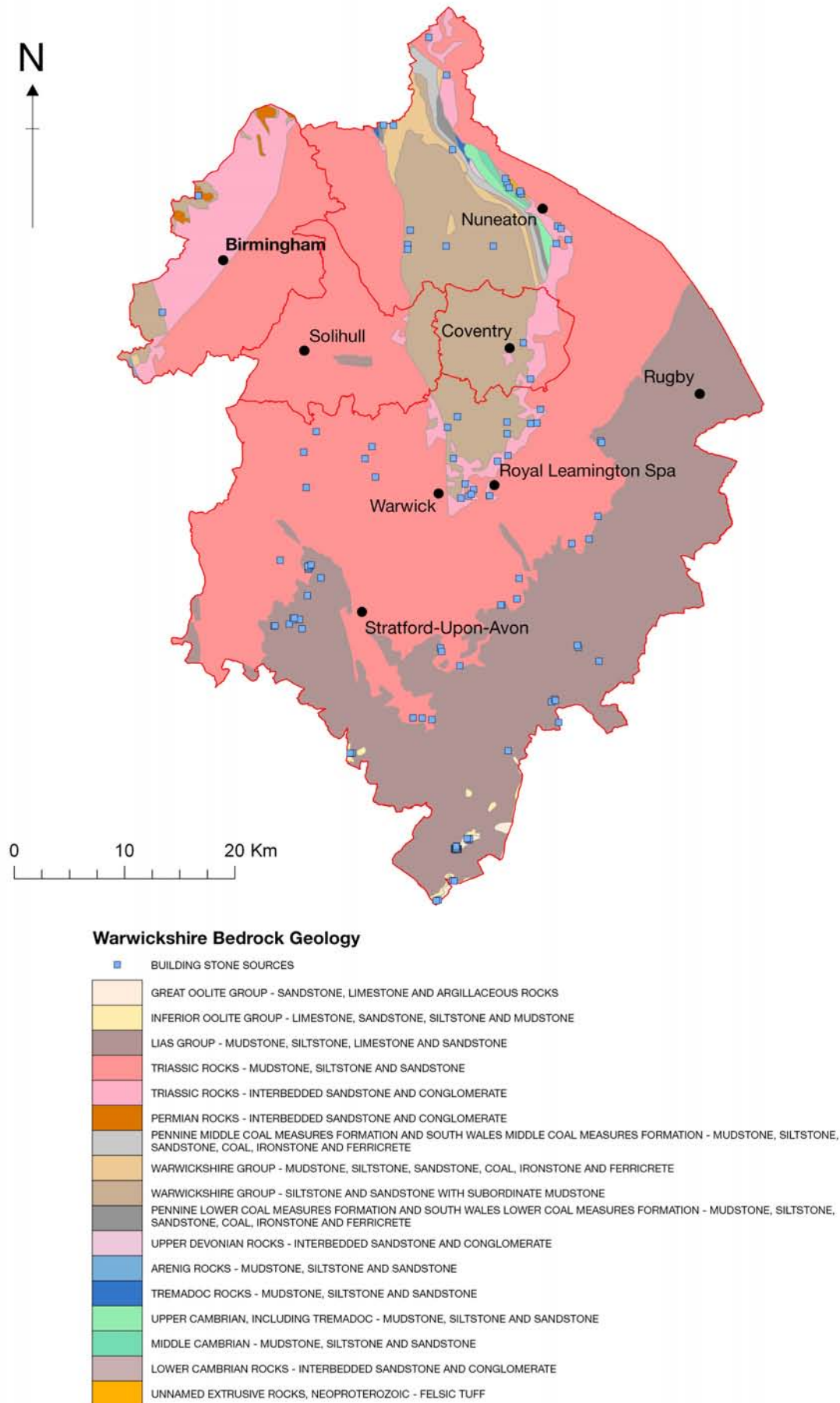
## A Building Stone Atlas of WARWICKSHIRE

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# Warwickshire Bedrock Geology



Click on this link to visit Warwickshire's geology and their contribution to known building stones, stone structures and building stone quarries (Opens in new window <http://maps.bgs.ac.uk/buildingstone?County=Warwickshire>)

# Introduction

The landscape in the county is clearly dictated by the underlying geology which has also had a major influence on the choice of building stones available for use in the past. The geological map shows that much of this generally low-lying county is underlain by the red **MUDSTONES** of the Triassic Mercia Mudstone Group. This surface cover is however, broken in the Nuneaton-Coventry-Warwick area by a narrow strip of ancient rocks forming the Nuneaton inlier (Precambrian to early Devonian) and the wider exposure of the unconformably overlying beds of the Warwickshire Coalfield (Upper Carboniferous to early Permian). In the south and east of the county a series of low-lying ridges are developed marking the outcrops of the Lower and Middle Jurassic **LIMESTONE**/mudstone successions.

The extensive urban development associated with the Birmingham Metropolitan area, previously part of north western 'Warwickshire', obscures much of the evidence for a stone quarrying industry in this part of the county. However, the presence of a number of significant historic stone structures suggests that even here stone quarrying was originally an important local industry. **LITHOLOGICALLY** the rock succession in the county is very varied and many different rock types have been used as sources of vernacular building materials. When the Romans left Britain in about 410 A.D., the Britons who were left behind, lost the art of building in stone. As a result, houses were constructed largely of wood, turf, straw or local mud, the latter known as cob. This building practice continued for the homes of the poor right up into the 15C. Only a few examples of such earth buildings survive in Warwickshire most notably at Dunchurch but there are plenty of garden walls built of cob which have stood for a significant time, especially along the valley of the Stour between Shipston, Tredington and Halford. As long as they are kept reasonably dry and protected, both from above and below, they last very well, but once they finally collapse, leave little trace.

Cob was suitable for small houses but when more space was needed it became necessary to build a wooden frame and use wattle fencing daubed with mud as the infilling or 'nogging' to make the walls. In nearly all surviving examples the wooden frame was built on a low plinth wall of whatever stone was available locally. In many cases this is the only indication we have of the early use of local stones. Adding the stone wall served to protect the wooden structure from rising damp. The infilling material has often been replaced later with more durable brickwork or stone. Sometimes, as fashion or necessity dictated, the original timber framed walls were encased in stone or brick cladding, especially at the front of the building where it was presumably a feature to be admired.

The Romans used bricks and tiles in Warwickshire although they seem to have preferred local stone and Swithland Slate (Leicestershire) for the villa constructed at Chedworth. The craft of brick-making seems to have departed with them and does not appear to have been revived until the 15C when brick came back into use. In England the earliest brick structures are generally found in the eastern counties where contact with the continent was most influential, gradually spreading across the country. Parts of Compton Wynyates date from this very early revival in brick building. The house dates from about 1500 and pre-dates the brick gatehouse of Charlecote Park by some 50 years. Bricks could be made wherever there was a supply of suitable clay, and this was abundant in the geological succession of Warwickshire. Small temporary kilns were built close to the 'construction site' and batches of a few hundred hand moulded bricks fired for up to six weeks. The results were predictably variable in a way which lends additional charm to these ancient brick structures.

# Quarrying for Building Stone

Quarrying for building stone in Warwickshire dates back to the earliest times. The quarrying techniques still used by the industry were largely introduced to Britain by the Romans. Initially the weathered blocks of stone found at and near the surface were gathered but later the deeper beds were exposed in quarries and the stones cut and dressed for 'FREESTONE' blocks.

## PRECAMBRIAN

### *Caldecote Volcanic Formation*

The complex succession of volcanoclastic rocks and associated intrusive igneous rocks that comprise the Caldecote Volcanic **FORMATION** are the oldest rocks of the county and crop-out to the north-west of Nuneaton. These rocks are still extensively quarried for aggregate, but were, in the past, a significant source of paving stones (setts) at the Blue Hole Quarry.

## CAMBRIAN

### *Hartshill Formation*

The oldest **SEDIMENTARY** rocks found in Warwickshire are of Cambrian age and comprise the sandstones (quartzites) that form the Hartshill Sandstone Formation in the ridge between Nuneaton and Hartshill Hayes. The sandstones were deposited as loose **QUARTZ** sand grains on the sea floor about 560 million years ago when life on Earth was first beginning to evolve. Since then it has been deeply buried and tectonically compacted, squeezing out mineral-rich pore waters to deposit **SILICA CEMENT** in the space between its grains, turning the loose sediment into a very hard, durable stone which is still worked for crushed rock aggregate.



Geologically the Hartshill **SANDSTONE** is renowned for its well preserved trace fossil assemblages which represent some of our earliest known life forms. This sandstone, though quite attractive, shows interesting shades of green and pale purple highlighting its generally grey coloration, has seldom been used for building work but is often seen as random blocks in local walls. The three buildings which have used this sandstone extensively are *Hartshill Castle* (bottom image), the ancient abbey church of St. Mary's in Nuneaton and the Holy Trinity Church, Hartshill. More recently the sandstone has also been used as irregular slabs for facing brick walls at the Holy Trinity and in St. John's Church at the southern end of Kenilworth.

## ORDOVICIAN

### **Igneous rocks**

These occur as **INTRUSIVE DIORITES** (mainly as sills) along the ridge north-west of Nuneaton where they have been and are extensively quarried, for example at Griff, Mancetter and Purley. The diorites are hard, intractable rocks and are rarely used in buildings. With careful examination occasional angular pieces of this blackish rock can be found in buildings, such as at the Church of St Peter, Mancetter (page 4). The diorites can be found locally as walling stone and were used in the past for the construction of railway bridges in the local area. However in modern times the diorites have been worked extensively for road stone aggregates, for example at *Mancetter Quarry*, top image. The quarries form a major landscape feature on the Nuneaton Ridge.





## CARBONIFEROUS & EARLY PERMIAN

### Warwickshire Group (formerly Barren Measures)

The Late Carboniferous rocks of the county comprise the Warwickshire Group and are restricted in outcrop to the area of the Warwickshire Coalfield, which extends north to south from Tamworth to Warwick and eastwards to Coventry and Nuneaton. The often reddened sandstones from the Halesowen, Keele and Kenilworth formations of this group were widely used locally for building stone. These sediments accumulated about 250 million years ago when the extensive delta-swamps, which characterised the earlier Pennine Coal Measures Group successions were drying up as the environment gradually changed towards the drier, desert conditions that characterise the Warwickshire Group.

St. Peter's Church in Mancetter (bottom image) is typical of many older stone buildings in the coalfield area, displaying a variety of local materials; notably brown sandstone from the Warwickshire Group. The sandstone can be lithologically variable; in places it is fine grained and almost white in colour while other blocks are pebbly (conglomerate) and much browner in colour:

In the south wall just to the right of the main door of the church the sandstone is still blackened with the industrial grime which once coated most old buildings in this area, downwind of the industrial city of Coventry. Above this grimy layer is a well coursed wall section and **BUTTRESS** of brown sandstone. This was probably quarried from the local outcrop of the Halesowen Formation. The upper part of the wall comprises poorly coursed '**RUBBLE-STONE**' containing some angular pieces of blackish rock which is probably a crystalline diorite.



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Elsewhere, the use of these reddened Carboniferous sandstones are widespread across their outcrop. Other examples include Astley Castle and Coombe Abbey near Coventry. The top left image shows Combe Abbey, the oldest parts are constructed of local red sandstone.

### Kenilworth Sandstone Formation

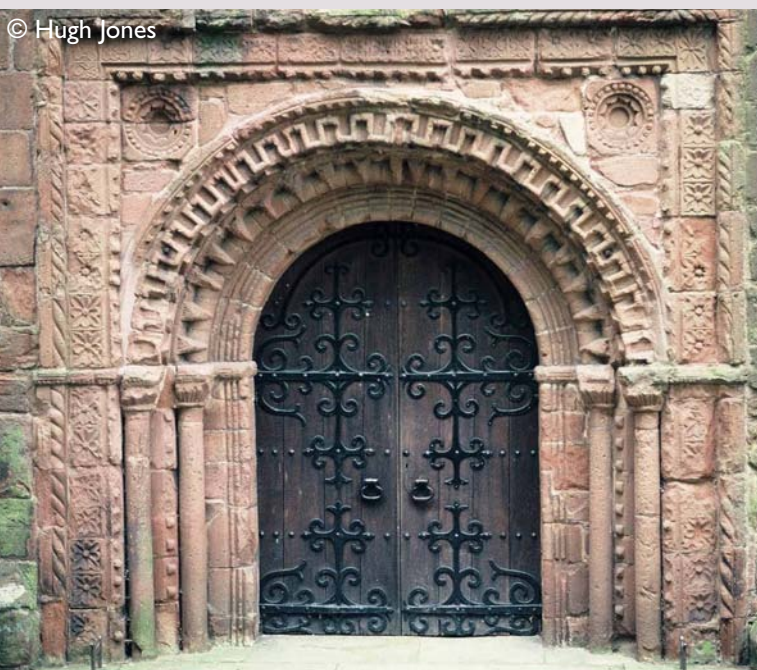
Widely used in local walls and buildings, the strongly **CROSS-BEDDED**, reddish sandstones that comprise the Kenilworth Sandstone Formation are probably best seen in the Castle and Priory Gatehouse at Kenilworth (middle left image). Cross-bedding is evident in many of the sandstone blocks, some have clearly been wrongly laid on edge in the wall, consequently causing the stone to weather and gradually fail.

The iron oxide hematite which gives the sandstones their marked reddish colour has often been severely affected by pollution. Acid rain, generated by smoky chimneys and car exhausts, has removed much of this **FERRUGINOUS**, grain-coating cement, reducing the surface of the sandstones to a loose 'friable' collection of quartz grains which are easily eroded away. The effects of erosion are very visible around the **QUOINS** and windows of the castle.

As there are no longer any local sandstone quarries in operation much of the replacement red sandstone used for conservation repair work is currently brought from the Permian sandstone quarries of the Dumfries area of Scotland (e.g. Locharbriggs Sandstone).

Perhaps one of the finest examples of the use of Kenilworth Sandstone in Warwickshire is in the elaborately carved Norman doorway of the Church of St Nicholas at Kenilworth (bottom left image).

Elsewhere, as in St Mary's Church at Haseley near Warwick, the reddened Kenilworth sandstones are juxtaposed with pale grey fine-grained Arden Sandstone of the Mercia Mudstone Group.







At Stoneleigh Abbey part of this substantial stone building is constructed of red Kenilworth Sandstone (east wing top image) while in contrast the principal façade of the west wing (bottom image) is constructed of pale grey Bromsgrove Sandstone. Recent restoration work on the west wing has used white Triassic Grinshill stone for major repairs. At Stoneleigh village, locally quarried sandstone from Motslow Hill is displayed in the almshouses.





# TRIASSIC

The Triassic succession is the principal source of building sandstones in the county. The Triassic, as elsewhere in the UK, is divided **STRATIGRAPHICALLY** into three units: the basal sandstone-dominated Sherwood Sandstone Group; the mudstone and evaporite-dominated Mercia Mudstone Group; and the thin transitional interval of marginal marine sediments and marine limestones, marking the top of the Triassic, known as the Penarth Group. Each of these groups was a prolific source of local building materials in the past providing sandstones, mudstones (for brick production) and limestones for construction.

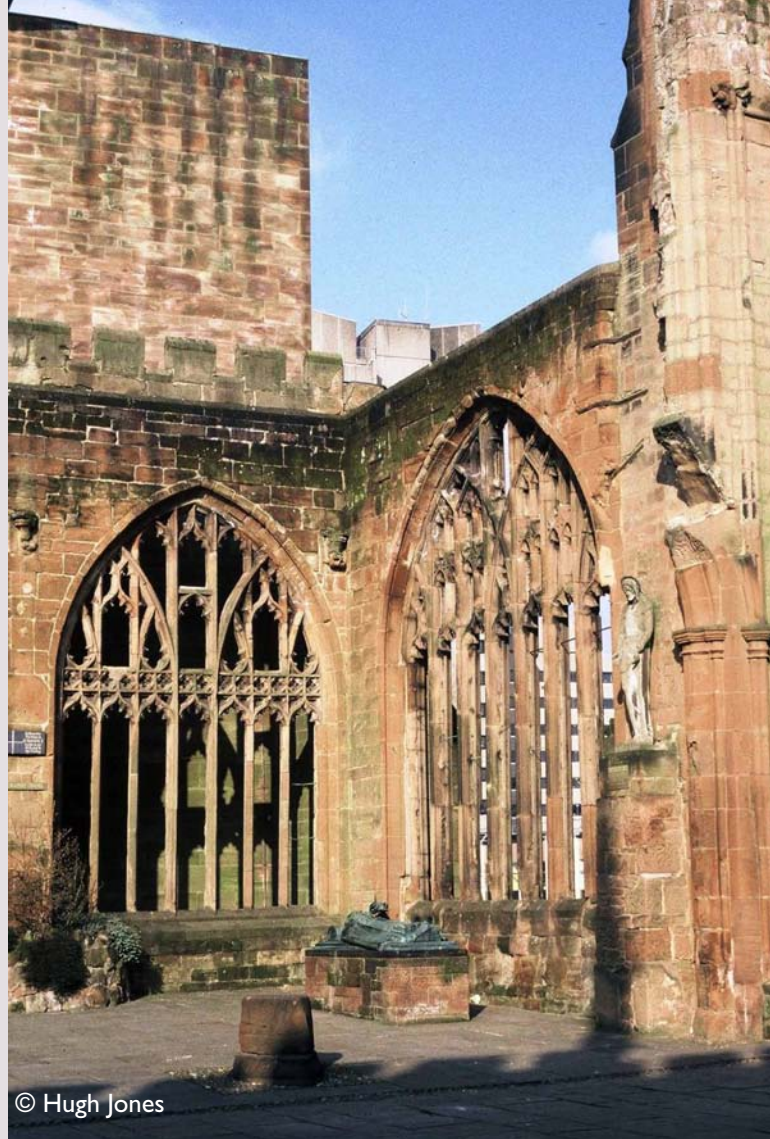
## Sherwood Sandstone Group

### *Bromsgrove Sandstone Formation*

#### **Warwick Stone**

The Bromsgrove Sandstone (formerly the Keuper Sandstone) is pale brown to off-white in colour, fine to medium grained, and commonly cross-bedded. Formerly it was extensively quarried for building purposes across its outcrop but there are no active quarries operating today. Most older towns and villages on the outcrop will have some stone buildings that have used the local Bromsgrove Sandstone as wall stones or **DRESSINGS**.

At Coventry the evocative ruins of the bombed Church of St Michael's (top right image) was constructed from the Bromsgrove Sandstone believed to have been quarried at Whitley. The new cathedral at Coventry is constructed of variegated purple-red and brown sandstone from the Triassic Hollington quarries in Staffordshire. In the southwest suburbs of Birmingham the remains of Weoley Castle (13C) confirm that the Bromsgrove Sandstone Formation, here locally reddened, was always an important source of local building stone wherever it was accessible in the county. At Warwick the local Bromsgrove Sandstone, pale greenish-grey in colour, was very widely quarried and used, most noticeably in the castle, city walls, gatehouses, and in many of its older churches and private houses. In this area the sandstone is sometimes referred to as Warwick Stone.



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In other areas of its extensive outcrop within the county local quarry names for the sandstone have also been used e.g. Attleborough, Marston Jabbett etc. The sandstone is weakly cemented and many buildings in Warwick and elsewhere, for example, are commonly patched or repaired with harder Triassic sandstones from the Hollington (Staffordshire) or Grinshill (Shropshire) quarries. Hollington Stone was used for refacing the Northgate Street frontages of the Law Courts and Shire Hall in 1948. Other notable Bromsgrove Sandstone buildings in the town include St Mary's Church, the Gaol, the Market Hall (1670) and St John's House Museum. Traces of many old quarries are found around the town including one in the Priory Park which is now a childrens' playground and perhaps the best known site at Rock Mill beside the River Avon between Warwick and Leamington, now partly concealed beneath a new housing development. It was from here that stone was carried, probably by river, to build the elegant new Banbury Road Bridge, built in 1794 to replace the old bridge beside the castle walls.



## Mercia Mudstone Group

### *Arden Sandstone Formation*

The Arden Sandstone is a unit that occurs approximately 300 m above the base of the Mercia Mudstone Group. This sandstone is pale coloured, fine to medium grained, poorly cemented and commonly exhibits trough, planar and small-scale ripple cross-**LAMINATION**. The sandstone attains a maximum thickness of 11 m and often forms well-developed escarpments, for example, north-east of Henley-in-Arden.

The Arden Sandstone has been quarried over a large geographical area in the past, although there are presently no active workings. The numerous former quarries were all rather small, perhaps because the sandstone units most suitable for use as a building stone are lenticular in shape and hence not laterally very extensive.

As the sandstone is poorly-cemented, it tends to suffer badly from the effects of weathering, therefore block replacement and repair is a common feature in older buildings. Despite its poor durability, many buildings in the Arden area originally used this sandstone as their principal building stone. In the Inkberrow area, however, the Arden Sandstone is particularly well-cemented, which allowed for more durable, exceptionally large blocks to be quarried. Buildings constructed of Arden Sandstone are common along most of its outcrop area. Notable examples include churches at Wootton Waven, Rowington, Tanworth in Arden, Solihull (St Alphege spire only) and the **manor house at Baddesley Clinton** (below image).



© Tarnia McAlester



Wootton Wawen Church has some of the oldest Arden Sandstone masonry in the county. Much of the building is 14C but the tower belongs to the 11C and the stonework is a very crude uncoursed rubble-stone. The later south facing walls of the nave and chancel are however built of dressed blocks of Arden Sandstone. Stratford-upon-Avon does not have a lot of early stone buildings, presumably because much of the town dates from the 15C and 16C when timber-framed construction was more widely practised. However, the 15C Clopton Bridge (below image), financed by Sir Hugh Clopton, is built of weathered, pale grey Arden Sandstone which clearly brings out its characteristic fine lamination. A more recent parapet at the top of the bridge is mainly OOIDAL limestone with odd fragments of other rocks such as the brown stones in the image which don't really match any local rock-type and are possibly of Northampton IRONSTONE. The bridge is one of several such medieval structures constructed of Arden Sandstone, which span the rivers Avon and Leam in Warwickshire.

Another fine example of the use of Arden Sandstone is the late 15C nave and tower of the Guild Chapel (again financed by Hugh Clopton). Here, in an unweathered state inside the building, the creamy white stone shows little evidence of lamination. Externally the Arden Sandstone has been partially clad with Hollington Stone from Staffordshire.

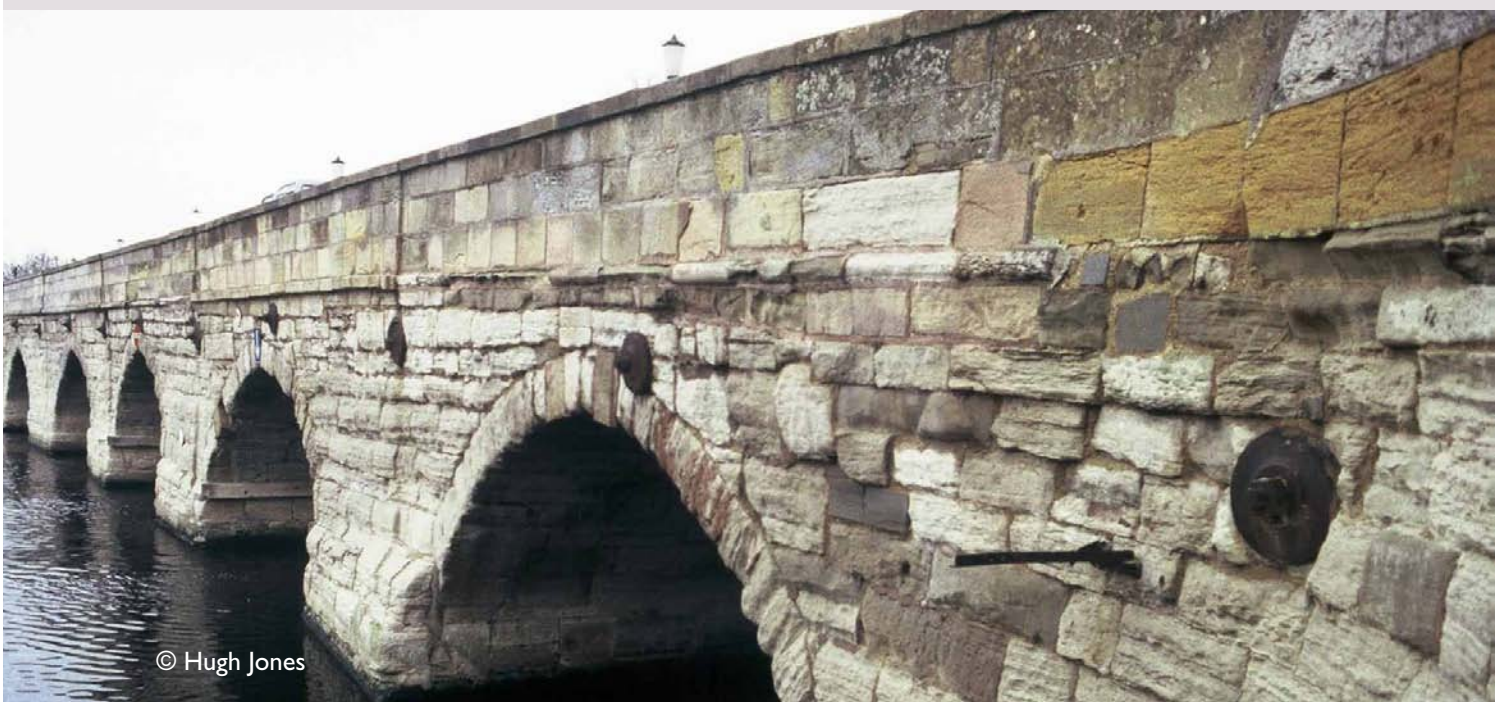
The oldest part of this chapel is the chancel which displays the use of large blocks of White Lias limestone reminiscent of, but earlier in construction than, Compton Verney House. In Warwick the columns of the tower of St. Mary's Church are constructed of Arden Sandstone from the Shrewley quarries.

## Penarth Group Lilstock Formation

### LANGPORT MEMBER

## White Lias limestone

The Mercia Mudstone Group is overlain by the Penarth Group, which is up to 14 m thick. The Penarth Group includes the Langport Member (formerly termed 'White Lias'), a limestone bed that has been widely used as a building stone in the southern and eastern part of the county. The White Lias Limestone is a pale grey, very fine grained MICRITIC variety with occasional BIOTURBATED FACIES and fossil concentrations. Another notable feature is the inclusion within some beds of locally reworked angular fragments of limestone (intraformational CONGLOMERATE). This is well shown in stones of the church and in other walls at Moreton Morrell and Southam. Most of the villages which commonly used White Lias Limestone lie along the outcrop. The limestone was used extensively as dressed blocks in the walls of Robert Adam's 18C Compton Verney House and in the columns and walls of Chesterton Windmill (1632).



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# LOWER JURASSIC

## Lias Group

### *Blue Lias Formation*

#### *WILMCOTE LIMESTONE MEMBER*

The Lower Jurassic succession conformably overlies the Penarth Group and crops out over much of the south and east of the county. The Group has provided grey and pale brown, fine grained, micritic limestones for local building purposes across much of its outcrop. The oldest beds of the Lias Group form part of the Blue Lias Formation and can be seen in the quarry at Southam overlying the Triassic White Lias (Langport Member) limestones. The formation typically comprises hard paler bands of impure limestone alternating with softer, darker, fissile clay-rich layers. Fossils including ammonites and bivalves are common in the limestones, and occasionally large reptilian fossils have been found in the quarries. The basal strata contain the best building limestone beds, locally known as the Wilmcote Limestone (Member). The unit was quarried at several localities to the north and west of Stratford, particularly at Wilmcote and Binton. The last quarries closed at the beginning of the 20C and few traces now remain.

The limestone which they produced is quite hard but thinly bedded and can be quarried as big slabs, and was much sought after for walling, flooring, doorsteps and even gravestones. The latter have not lasted well as when set vertically in place they eventually split and fail when damp and frost attacks the exposed, laminated edges. Wilmcote Limestone was also used for the flooring in parts of Sir Charles Barry's new Houses of Parliament in Westminster.

Numerous buildings and other stone structures testify to the importance of the use of these local Lias Group limestones across the outcrop and only a few can be mentioned here. Ragley Hall - 1690, is built of Wilmcote Limestone with Arden Sandstone dressings. The medieval bridge at Bidford-on-Avon was built mainly of local Wilmcote Limestone, though it has been patched with several other stones. In the cutwaters there are slabs of ooidal Cotswold limestone and Bromsgrove Sandstone, as well as patches of red brick where the stonework has been dislodged by boats or tree trunks swept along on the swirling flood waters which sometimes surge down the river. *Kinwarton Dovecote (below image), built of Wilmcote limestone, covered with an old cement render and a sandstone doorway.*



© Hugh Jones



The medieval church of St John the Baptist at Aston Cantlow, is situated just off the Blue Lias escarpment and is famous as the place where William Shakespeare's parents were married in the 16C. The walls are mainly of Wilmcote Limestone, whilst the window mouldings are of Arden Sandstone, or in the newer replacements, pale yellow Cotswold ooidal limestone. Set into the north wall is a small window blocked with pale grey Arden Sandstone, containing a weathered, recumbent figure, flanked with pale brown Bromsgrove Sandstone.

At nearby Billesley, the village, which largely disappeared during the 'black death', remains a Jacobean stone manor house and a fine church, all built and floored with Wilmcote Limestone. Slightly further afield both Mary Arden's house and Ann Hathaway's cottage made use of Wilmcote Limestone plinths to support their timber framed construction. In towns like Stratford and Alcester, where many of the houses are timber framed, it is often by looking at these low walls on which they stand that we can recognise what stone was available locally (bottom image shows the use of Wilmcot Limestone as a plinth for a timber framed building).



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The distinctive church ruin just outside Ettington is part of an interesting slice of local history. The original Norman parish church (Holy Trinity) was very close to the family seat of the Shirley family at Ettington Park, too close perhaps so they gave the village a new one and let most of the original building fall to ruin; surviving parts now present a romantic setting alongside the present hotel. St Thomas's (top image) was erected in 1798 but became unsafe and was yet again replaced by the present village church, built this time of Middle Jurassic Cotswold ooidal limestone in 1902. The ruin of St. Thomas's is just the tower of the Georgian church, the nave and chancel have long since been demolished. As a structure this is most unusual being made almost entirely of the very impure, clay-rich Rugby Limestone which forms hard bands in the Blue Lias Formation but does not weather particularly well. The Blue Lias Formation in Warwickshire has also long been quarried in vast pits to feed the national cement industry. Its high clay content meant that it could be used to produce 'hydraulic' lime rather than pure lime on burning.

The availability of such a range of local building stones in Warwickshire has meant that a number of stone buildings in the county have used many varieties of stone in their construction.



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At the Church of St. Nicholas, Loxley (below image) the local building stone is White Lias Limestone, hard and pale grey which is used in small blocky fragments. Individual pieces are generally quite small, flattish and only 50-75 mm thick. It is used for the chancel of the church where much of it was laid in a 'HERRINGBONE' pattern though some was laid flat and roughly coursed. In contrast the quoins at the east end and the LANCET window in the chancel are of red sandstone from the Warwickshire Group which was probably sourced from the Kenilworth area. The grey stone of the rounded 18C window, also in the chancel, has the appearance of Arden Sandstone and the nave, traditionally maintained by the parishioners, was rebuilt in the 18C using pale brown Bromsgrove Sandstone from the Warwick area. Yet another striking contrast is added by the rich brown ironstone used in

the 13C tower. This is the distinctive Hornton Stone (Marlstone Rock Formation) from Edgehill about ten miles to the south in Oxfordshire. The topmost section of the tower was added later and is of pale brown Bromsgrove Sandstone.

On the west-facing wall of the tower is yet another local stone, the banded Wilmcote Limestone so typical of the Stratford area and probably brought all the way from Wilmcote. The whole structure is beautifully set off by red clay tiles which have weathered to several different shades, enhanced with colourful patches of lichen and green algae.



© Hugh Jones



## Marlstone Rock Formation

### Hornton Stone

For centuries the Marlstone Rock Formation, or Hornton Stone has been worked as an iron ore and building stone at Edge Hill and Burton Hill. It is a distinctive dark brown ferruginous (**CALCITE**, **SIDERITIC** and **BERTHIERINE**-rich) ooidal and shell-fragment ironstone. In walls it usually shows very dark rusty looking streaks and sometimes contains fossils. The tops of Burton Dassett and Edge Hill are pock-marked by defunct iron ore quarries and pits. Perhaps one of the most distinctive buildings that has made extensive use of the ironstone is the hotel at Ettington which is constructed of a **POLYCHROMATIC** mix of Hornton Stone, Cotswold ooidal limestone, Wilmcote and White Lias limestones.

At Kington (bottom image) the use of pale Blue Lias limestone wall stones with contrasting window and door mouldings of brown Hornton Stone is a characteristic feature of the stone housing in many other villages in this part of the county. Hornton Stone also has an important place in local churchyards where it is still widely used for gravestones and carved memorials. Nationally Hornton Stone gained considerable international fame as a result of its frequent use by the sculptors Barbara Hepworth and Henry Moore for many of their pieces.



## MIDDLE JURASSIC

### Inferior Oolite Group

#### Birdlip Limestone Formation

### Cotswold Stone

There are limited outcrops of Middle Jurassic limestone along the southern borders of the county but nevertheless these pale yellow ooidal and **BIOTIC** limestones are a common feature of buildings in the area as can be seen in the above image of Long Compton village which is built of ooidal limestone. Only a few small quarries (e.g. Ebrington Hill, Oakham and Rollright) are known within the county and much of the stone actually used probably came from the larger quarries of the Cotswold area to the south. The limestone is widely seen in the uncoursed rubble-stone walls of village houses and in the drystone field walls. However, in more elaborate buildings like churches and manor houses, the stone used was of much higher quality, comprising squarely cut ashlar block.





In this southern area 'Cotswold Stone Slates' are commonly used for roofing with the slates arranged in characteristic diminishing courses, with the smallest slates used at the ridge and largest slates along the eaves. Only certain lithologies of the Cotswold limestones can split in this way and the principal local source was at Stonesfield in Oxfordshire. Here the limestone was excavated from shallow underground mines and the abandoned access shafts can still be found around the village. Perhaps the earliest example of the use of stone for construction in Warwickshire are the **Rollright Stones (bottom image) or more specifically the King's Stone, as the remaining stones lie just over the border in Oxfordshire.** This ancient standing stone is of the local ooidal Cotswold limestone, on which it actually sits, and was probably sourced not far from its site. The stones are very rough and irregular in shape and size, and are believed to have been erected some five thousand years ago.

## PLEISTOCENE

*FLUVIO-GLACIAL 'DRIFT'*

### **Heathstone, Ferricrete**

The youngest strata of Warwickshire are the unconsolidated Pleistocene fluvio-glacial sands and gravels that mask much of the land surface. Ice sheets advanced over Warwickshire during the Pleistocene which comprised periods of intense cold 'glacial' periods interspersed with much warmer 'interglacial' intervals. At times the ice may have been more than a hundred metres thick in the north of the county but thinned southwards and never extended much beyond Edge Hill.

This mobile ice sheet carried rock and soil scraped up from the country to the north which was then deposited as glacial 'drift' as the ice gradually melted. Occasionally this drift contains large boulders which are referred to as 'glacial erratics'. Where the rock type is distinctive the boulders can sometimes be used to pinpoint the source from which they came and from that deduce the direction of ice movement. Mostly we have been left with a thin covering of sand and gravel which here and there is thick enough to provide a ready source of aggregate for the construction industry. The thickest and most extensive deposits lie north and west of Rugby, including Dunsmore Heath. In a few places pebbles and boulders from the 'drift' have been collected and used in the walls of buildings. The church at Churchover is a particularly good example where the 15C tower is principally White Lias limestone (locally sourced) but the nave and chancel, rebuilt late in the 19C are entirely clad in split cobbles and boulders of great variety. Another interesting example is St. Mary's Church at Clifton on Dunsmore where the tower is a mix of grey and reddish sandstones typical of the Coventry area; the rest is mainly ironstone, some of which is the dark brown Hornton type and some the yellower, sandy, Northampton Sand (or Ironstone) which becomes increasingly common towards Daventry.

Scattered among the ironstones are pebbles and cobbles of hard brown sandstone from the local 'drift' and blocks of very dark brown conglomerate. The conglomerate comprises a variety of rounded pebbles, not more than a few centimetres across; and in some blocks lots of similar sized angular flint pebbles.



© Hugh Jones



Local studies have found this ferruginous 'pebble rock' to be fairly widespread on Dunsmore Heath where it seems to have formed as an iron-pan or ferricrete at a depth where it interferes with deep ploughing. Such layers are often developed where mineral-rich groundwaters dissipate as they near the surface, precipitating a hard chemical crust or hardpan layer which was subsequently collected as a building material sometimes termed Heathstones.

## Imported stones and the demise of local quarries

It was improved transport links, first the canals at the end of the 18C and then the railways from the middle of the 19C which allowed stone to be transported economically over great distances; eventually leading to the closure of most local quarries. A fine example of the impact of these imported stones on the local stone industry is presented by Rugby School. Pre-mid 19C buildings in the school complex use local Bromsgrove Sandstone for dressings, but by 1859 when the new school buildings, constructed by William Butterfield, using his distinctive polychromatic style, applied a mix of red brick and yellow ooidal limestones (Bath Stone) from the Box Ground quarries in Wiltshire.

Moreton Morrell Hall - 1906 (bottom image) is yet another such example constructed of ooidal limestone also from the stone mines at Bath. By this time Bath and other stones could be supplied by rail to any station in the country.

Today stones are imported from all over the world for use in new town and city developments and the closure of local quarries has meant there is no longer any local competition to these imports. The City of Birmingham is typical of many of the UK's large urban centres. The Cathedral Church of St Philip constructed in the early 18C used Arden Sandstone from the Rowington quarries. However, as a result of its subsequent severe decay, it was almost completely replaced over the 19C and 20C with Stancliffe Darley Dale sandstone (Millstone Grit) from Derbyshire, White Mansfield (Permian) from Nottinghamshire, White Hollington Stone (Triassic) from Staffordshire and Dunhouse sandstone (Pennine Coal Measures) from County Durham. By the 19C stones from throughout the UK were being used in Birmingham, perhaps the most distinctive being the coarsely fossiliferous Anglesey Marble (Carboniferous Limestone) for the Town Hall which was recently refurbished using the same limestone source, the Penmon quarries in Anglesey.





# Glossary

**Berthlerine:** A green variety of Chamosite: An ore mineral.

**Bioclastic:** Term used to describe fragments of any skeletal material e.g bioclastic limestone, bioclastic sandstone.

**Bioturbated:** The stirring or mixing of sediment or soil by organisms.

**Buttress:** A projection from a wall and bonded to the wall to create additional strength and support.

**Calcite:** A mineral made of calcium, carbon and oxygen —  $\text{CaCO}_3$ ; the principle carbonate component of limestone, Chalk and marble.

**Cement:** The materials which bind the grains and/or fossil components together to form a rock

**Conglomerate:** A sedimentary rock made up of rounded pebbles (>2mm), cobbles and boulders of rock in a finer-grained matrix.

**Cross-bedded:** A feature principally of sandstones formed by the movement of sand grains in currents to produce layering oblique to the margins of the beds.

**Diorites:** A medium to coarse-grained intrusive igneous rock.

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

**Facies:** A term describing the principal characteristics of a sedimentary rock that help describe its mode of genesis e.g. dune sandstone facies, marine mudstone facies.

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

**Formation:** A named lithostratigraphic rock unit, with recognizable boundaries, readily identified by mapping, that forms part of a Group e.g. Bromsgrove Sandstone Formation.

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

**Herringbone:** When any stone, timber or brick building material is laid aslant instead of being bedded flat, and is found in paving, nogging and walling.

**Intrusive:** A body of igneous rock formed from molten magma that has been injected into pre-existing rock.

**Ironstone:** Sedimentary rock which is composed of more than 50% iron-bearing minerals.

**Lamination:** The thinnest type of layering in sedimentary rocks, less than 1 cm in thickness.

**Lancet:** A tall narrow window with a sharply pointed arched head. A lancet window was a common feature of First Pointed or Early English Gothic architecture.

**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.

**Lithologically:** A basic description of the material features of a rock, generally as seen with the naked eye, but also including microscopic features. Commonly occurring sedimentary lithologies are sandstone, siltstone, mudstone and limestone; commonly occurring igneous lithologies are granite, diorite, dolerite and basalt.

**Micritic:** Limestone consisting of microcrystalline calcite mud or a very finely crystalline carbonate cement.

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

**Ooidal:** A spheroidal grain of calcium carbonate formed by precipitation (by algae) of calcium carbonate in concentric layers.

**Polychromatic:** The decoration of exteriors, and interiors of buildings with several colours. Structural polychrome decoration means that the colour is not applied but is in the bricks, tiles or stones used in the construction.



**Quartz:** The crystalline form of silica (silicon dioxide, SiO<sub>2</sub>).

**Quoins:** The external angle of a building. The dressed alternate header and stretcher stones at the corners of buildings.

**Rubblestone:** 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).

**Sedimentary:** A rock that is commonly formed by the binding together (lithification) of sediment particles (e.g. sandstone, siltstone, mudstone, limestone).

**Sideritic:** Iron carbonate (FeCO<sub>3</sub>), a widespread carbonate mineral that can be an ore of iron. The mineral commonly occurs in thin beds with shales, clay, or coal seams (as sedimentary deposits) and in hydrothermal metallic veins (as gangue, or waste rock).

**Silica:** The resistant mineral quartz (silicon dioxide) SiO<sub>2</sub> an essential framework constituent of many sandstones and igneous rocks, but it also occurs as a natural cement in both sandstones and limestones.

**Stratigraphically:** 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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## Further Reading

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