

# STRATEGIC STONE STUDY

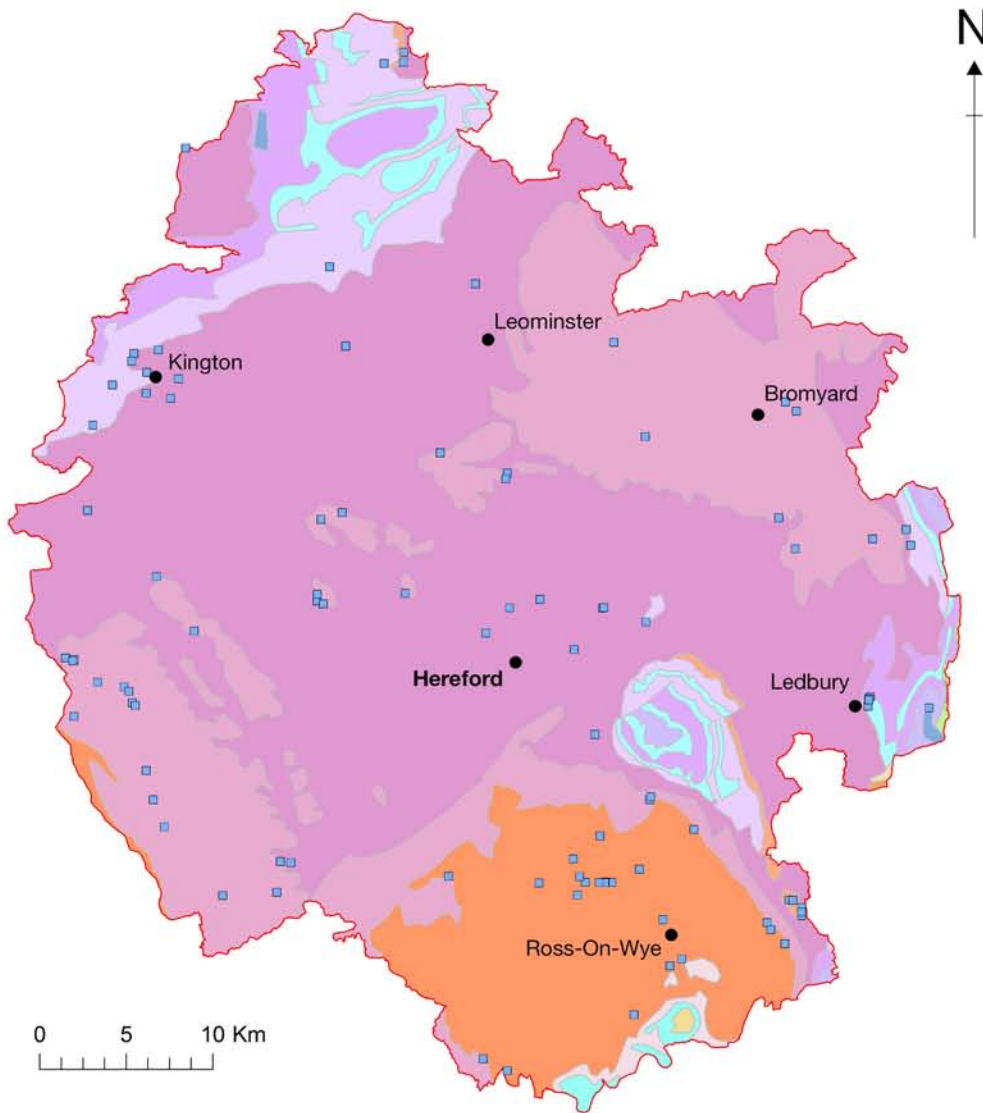
A Building Stone Atlas of  
Herefordshire

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# Herefordshire Bedrock Geology



## Herefordshire Bedrock Geology

■ BUILDING STONE SOURCES

### Bedrock Geology

	TRIASSIC ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	PERMIAN ROCKS (UNDIFFERENTIATED) - SANDSTONE AND CONGLOMERATE, INTERBEDDED
	WARWICKSHIRE GROUP - MUDSTONE, SILTSTONE, SANDSTONE, COAL, IRONSTONE AND FERRICRETE
	SOUTH WALES UPPER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE, SANDSTONE, COAL, IRONSTONE AND FERRICRETE
	DINANTIAN ROCKS (UNDIFFERENTIATED) - LIMESTONE WITH SUBORDINATE SANDSTONE AND ARGILLACEOUS ROCKS
	UPPER DEVONIAN ROCKS (UNDIFFERENTIATED) - SANDSTONE AND CONGLOMERATE, INTERBEDDED
	LOWER DEVONIAN ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	LOWER DEVONIAN ROCKS (UNDIFFERENTIATED) - SANDSTONE AND CONGLOMERATE, INTERBEDDED
	PRIDOLI ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	PRIDOLI ROCKS (UNDIFFERENTIATED) - SANDSTONE AND CONGLOMERATE, INTERBEDDED
	LUDLOW ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	WENLOCK ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	LLANDOVERY ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	SILURIAN ROCKS (UNDIFFERENTIATED) - LIMESTONE, MUDSTONE AND CALCAREOUS MUDSTONE
	TREMADOC ROCKS (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
	UNNAMED EXTRUSIVE ROCKS, NEOPROTEROZOIC - MAFIC LAVA AND MAFIC TUFF
	UNNAMED IGNEOUS INTRUSION, NEOPROTEROZOIC - FELSIC-ROCK
	UNNAMED IGNEOUS INTRUSION, NEOPROTEROZOIC - MAFIC IGNEOUS-ROCK

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

## Introduction

Herefordshire is one of the most sparsely populated counties of England. With only six towns of any significant size – Hereford, Leominster, Bromyard, Ledbury, Ross-on-Wye and Kington – and a wide scatter of mostly small villages and isolated hamlets, it is the natural rather than the man-made features that dominate the landscape. If one looks for a regional architectural style within this essentially rural landscape, it is the timber-framed or ‘black-and-white’ that is most striking. This is particularly so in the northwestern quarter of the county, where a tourist trail known as the ‘Black and White Village Trail’ has been developed.

A closer examination, however, reveals that the vernacular architecture strongly reflects the local geology. Large swathes of the county are underlain by the three main formations of the local ‘Lower Old Red Sandstone’ succession i.e. the Late Silurian Raglan Mudstone Formation (part of the Downton Group) and the Early Devonian St Maughans and Brownstones formations. Within the areas underlain by strata assigned to these units one almost always finds that the village church is built from local stone. The plinths upon which the sole-plates of timber-framed houses rest are, or were, of local stone, linking the house above ground almost ‘organically’ to the rock beneath. A few farm buildings are stone-built, at least on their gable ends, and a small number of C17 to C19 houses are constructed of stone. Such was the isolation of the county’s settlements, with only inadequate roads, no canals and a poorly developed railway network, the stone that was used up until the mid-C19 would have come from very local sources.

Only in four areas of Herefordshire – the north-west corner of the county, a narrow strip along the western flank of the Malvern Hills (East Herefordshire), a very small area adjacent to May Hill in the far south-east, and a roughly circular area taking in the concentric **LIMESTONE**

**OUTCROPS** of the Woolhope Dome – are there any significantly different rock types present, and this is once again reflected in the stone-use in these areas.

A striking feature of the stone buildings in most parts of the county is the variability of the stone itself, especially within the churches. There is none of the uniformity of, for example, a Cotswolds village. The stone varies in colour and texture, often within a single wall, ranging from purple-red to greenish-grey and including coarse-grained **SANDSTONES** through to well laminated, fine-grained sandstones and very soft **SILTSTONES**. This is particularly the case with the lithologies of the Raglan Mudstone and St Maughans formations.

From the mid-C19 century onwards, with improved transport facilities, a certain amount of stone was ‘imported’ from beyond the county boundary, notably for church restoration work (which required better quality material for window frames and tracery, in particular). Much of this was either Jurassic limestone from the Cotswolds, or Triassic sandstone from neighbouring Shropshire or Worcestershire.

## PRECAMBRIAN

### MALVERNS COMPLEX

#### 'Malvern Stone'

The Herefordshire–Worcestershire county boundary follows the crest of the Malvern Hills at their southern end. Some stone, especially from small quarries located on the western flank of the range, has been used in buildings found immediately to the west. The Malvern stones comprise a mixture of meta-**IGNEOUS** lithologies which yield a rubbly, but nonetheless attractive, building stone. The typically strongly sheared and faulted nature of the Malverns Complex rocks makes them very difficult to cut, and true dimension stone is only rarely seen. Despite this, the stone has been used in the construction of a few houses around Colwall and more extensively as a rough walling stone as far west as Ledbury. The stones are often grey, pink or green, but due to their variable composition, frequently show a wide range of colours, both when fresh and weathered.

### Wentnor Group

#### Brampton Formation

#### Broomie Hill Stone

On the opposite side of the county, in the far northwestern corner, lies a small sliver of Precambrian (Ediacaran) strata, comprising variably coloured sandstones and conglomerates. Structurally, the outcrop is a portion of the 'western Longmyndian' caught up within the splays of the Church Stretton Fault system. The main quarry is found on the Brampton Bryan Estate, and this produced a **SEDIMENTARY** rock which rarely shows definite bedding or lamination; it has almost always been used as blocks of irregularly shaped rubblestone. The stone was used on the estate for boundary walls, for farm buildings and for estate workers cottages, and within the village of Brampton Bryan itself.

The upper right image of Brampton Bryan Estate cottages at Walford shows the inherent irregularity of the blocks, which necessitates the use of brick for quoins, sills and lintels. Buckton Mill near Brampton Bryan, a late C18 to early C19 water mill (lower right image), serves to highlight the contrast between the grey siltstone of the Upper Ludlow Shales Group (used for the mill building) and the Broomie Hill Stone from the Brampton Bryan Estate.

## CAMBRIAN

### Hollybush Sandstone Formation

#### Hollybush Sandstone

The Hollybush Sandstone is not commonly used owing to its restricted outcrop, but this green, flaggy, micaceous sandstone can be seen in farm buildings and walls in the area around Hollybush Quarry at the extreme southern end of the Malvern Hills.

## SILURIAN

During the Silurian, Herefordshire lay on the eastern margin of an ocean basin which stretched westwards through what is modern-day Wales. This was a time of fluctuating sea levels which saw the deposition of shallow-water sediments ranging from fine-grained sandstones and siltstones to **FOSSILIFEROUS** limestones.

There are four separate areas within Herefordshire where Silurian rocks crop out, three of which are sufficiently extensive to have had some impact on the local built environment.



## SILURIAN of north-west Herefordshire

The most extensive development of Silurian rocks occurs in the northwestern part of the county, where the distinctive ridge-and-vale topography that characterises Shropshire to the north continues across the county boundary into Herefordshire, Folding affects these strata, notably forming the Ludlow Anticline and giving rise to the pronounced horseshoe-shaped outcrop pattern of the Wigmore area. Moving southwestwards, the strata resume their NE–SW strike, extending to Kington and beyond into Wales.

### WENLOCK 'SERIES'

#### *Much Wenlock Limestone Formation*

#### **Wenlock Limestone**

By the time it crosses into Herefordshire from Shropshire, the classic escarpment of the Wenlock Limestone is a much reduced topographical feature when compared to the more prominent ridge created by the Aymestry Limestone. Though quarried and burnt for lime in the vicinity of its outcrop within the Vale of Wigmore, only a handful of properties around Pipe Aston incorporate this limestone in their structures.

### LUDLOW 'SERIES'

#### *Aymestry Limestone Formation (sic)*

#### **Aymestry Limestone (sic)**

North-west Herefordshire and south-west Shropshire are the classic research areas for the rocks of the Ludlow 'Series' and form the basis of the Ludlovian stratigraphical framework. From a building-stone perspective, however, a classification based on rock type is most appropriate, not least because the best building stone yielded by this 'series' – the Aymestry Limestone – is diachronous and, in this part of Herefordshire, tends to be variable in its limestone content, grading into the Lower Ludlow Shales Group (below) and Upper Ludlow Shales Group (above) to such an extent that both the precise age and source of the 'limestone' blocks observed in buildings are often difficult to determine.

A very large quarry within Aymestry\* itself, known as the Great Quarry, evidently produced much of the stone seen in the village (image below). The succession in this quarry comprises fine-grained and well-laminated 'Lower Ludlow Shales', which are overlain by the more lime-rich, shelly beds of the true 'Aymestry Limestone' (characterised by the large, strongly ribbed shells of the brachiopod *Kirkidium knightii*); these are in turn succeeded by a thin development of 'Upper Ludlow Shales'.

\* NB. the 'geological' spelling of Aymestry lacks the second 'e' of the modern village name spelling.

Aymestry is typical of the villages of this area in having a church built predominantly of local stone, with several cottages and outbuildings of stone and numerous stone boundary walls fronting onto the main street. The latter are often of the more slabby 'Ludlow Shales', which were more easily coursed than the limestone blocks, but have weathered badly.



The top right image shows a farmhouse and boundary walls constructed of 'Aymestry Stone' produced from the Aymestry Great Quarry (which lies behind the hill seen to the rear of the building).

Other villages following the same pattern of locally quarried stone-use include Leintwardine, which has employed Ludlow rocks ('Upper Ludlow Shales') quarried from Church Hill above the village.

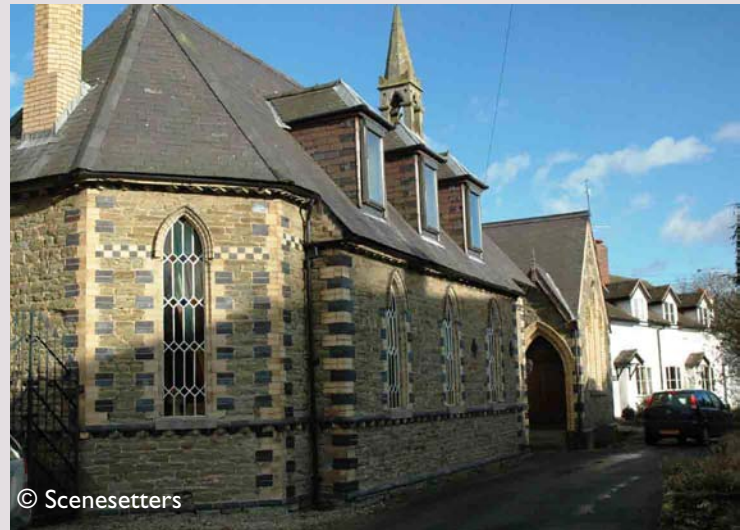
Bank House in Leintwardine (image below) typifies the buildings of the village's High Street.

The Old School, Leintwardine (middle right image) features polychromatic bricks and walls of siltstone from the 'Upper Ludlow Shales'.

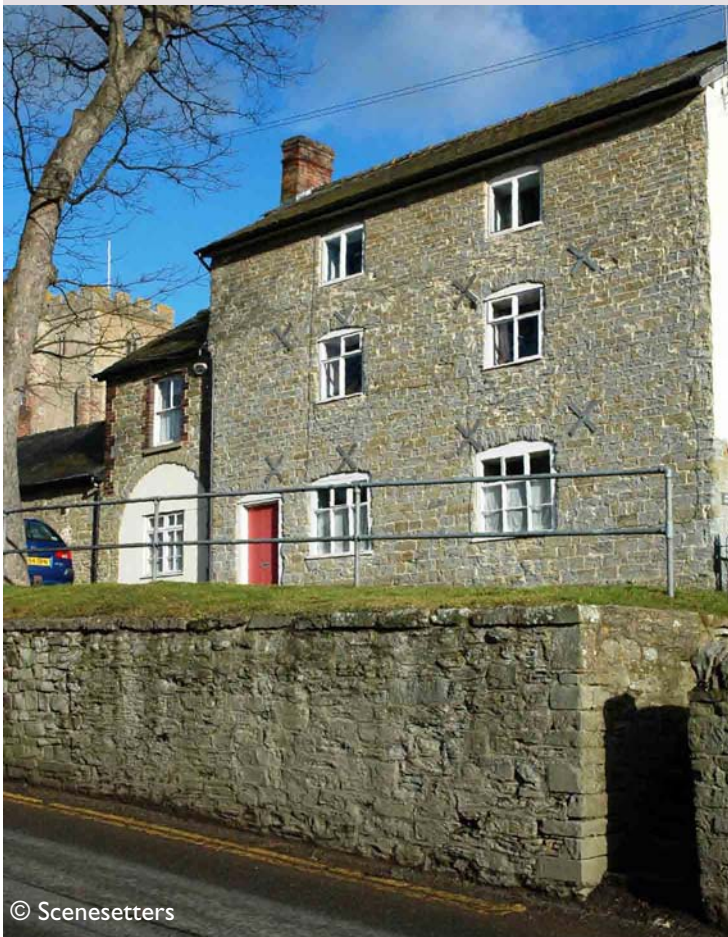
Leintwardine Church (bottom right image) is largely constructed of Ludlow 'Series' rock types, though they clearly represent different build periods and were probably from different sources. The window surrounds and **BUTTRESSES** are of better quality sandstone, possibly 'Grinshill Sandstone' (from the Triassic of Shropshire), suggesting either a deliberate selection of two contrasting colours or a lack of suitable local dimension stone sources.



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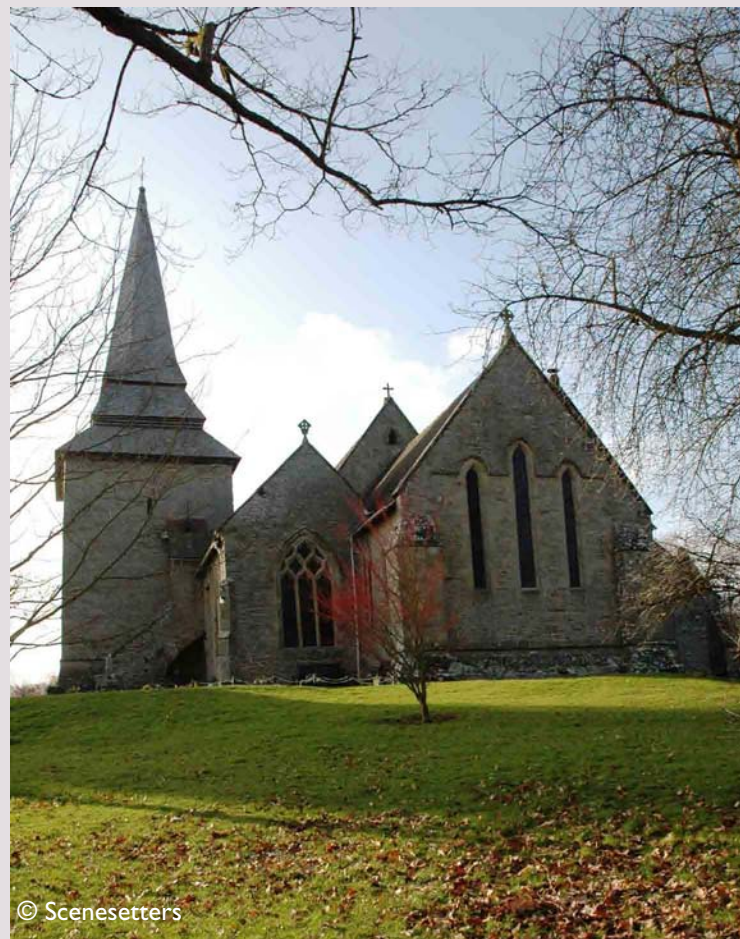
The village of Wigmore has a similar mix of buildings, with a few stone dwellings, a ruined Castle on the ridge outside the village, and a church which clearly exhibits the various lithologies of the local Ludlow succession. The oldest stonework dates to late Saxon times and was laid in a herringbone pattern. The top right image shows the Saxon herringbone walling in the north nave wall of Wigmore Church. The west transept wall (to the left) is the later and more typical Ludlow 'Series' siltstone. A close-up view of the herringbone masonry is provided below.

Other small villages lying within or just outside the outcrop area of the Ludlow 'Series', such as Bircher, Byton, Kinsham and Titley, show similar limited use of these siltstones and limestones in churches and agricultural buildings. Further south-west in the small border town of Kington (as in most towns), the stone-built nature of the buildings is somewhat concealed by the main street frontages. Down the alleys and in the older parts of the town, however, Ludlow 'Series' stones are in evidence (e.g. several rows of cottages found on the western side of the town and the church on top of the hill). These show the same variations in hardness, colour (grey to pale brown), grain size and lithology that characterize the villages previously mentioned. The rocks were quarried in part from the steep slopes below the church and from a number of quarries located to the west of the town.

Kington Church (bottom right image) shows a greater uniformity of stone type than is seen in many other churches..



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In many towns, rows of cottages constructed of the local Ludlow 'Series' lithologies display a more regularly coursed appearance to the front than to the sides and rear (top right image).

As in the smaller villages, Kington is also characterized by extensive stone boundary walls to gardens, as can be seen in the lower right image.

The image below shows some of the older cottages in Kington which are constructed of Ludlow 'Series' lithologies, but roofed with flagstones from the younger Raglan Mudstone Formation (which were produced by small quarries situated on the lower slopes of Bradnor Hill across the valley to the north).

## SILURIAN of east Herefordshire

The east Herefordshire outcrop of Silurian strata is of varying width and runs along the eastern edge of the county following the western side of the Malvern Hills from Cradley through Colwall to Eastnor Park and then extending westwards in the direction of Ledbury. The strata here include beds of older age than are present in the north-west of the county and, in general, they have been used rather less systematically as building stone.





## LLANDOVERY 'SERIES'

### May Hill Sandstone Group

Consisting of purple-brown to buff, coarse-grained sandstones, 'grits' and conglomerates, the Llandovery 'Series' beds would have made a more important local building stone were they not restricted to a small outcrop in the Eastnor Park area, just west of Midsummer Hill. It is recorded that they were used in the construction of Bronsil Castle, as well as in other local farm buildings and walls.

## WENLOCK 'SERIES'

### *Much Wenlock Limestone Formation*

#### **Wenlock Limestone**

In this part of the county, the Wenlock Limestone crops out along the border with Worcestershire around Cradley, as well as forming part of the ridge east of Ledbury. It was quarried predominantly for lime-burning, but close to the outcrops around Cradley and in Ledbury, examples can be found of its use in cottage and boundary walls e.g. St Katherine's Hospital.



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The image below shows an old barn of Wenlock Limestone on the east side of Ledbury.

The image above is a close-up view of a fossiliferous Wenlock Limestone wall located along a back-street in Ledbury.



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## Ledbury Marble

This is a stone type of particular note that occurs within the Much Wenlock Limestone Formation. It is a hard, crystalline, fossil-rich limestone, which was polished for use locally as a decorative stone. It was worked at Upper Hall Farm (a SSSI) and in the adjacent Commissioner's quarries near Ledbury. Although Church Street is the epitome of 'Black-and-White' timber frame buildings, Wenlock Limestone features as **COBBLES** (some of which clearly show crinoid fossils; right image).



## LUDLOW 'SERIES'

### *Lower and Upper Ludlow Shales groups and Aymestry Limestone Formation*

Although, as in the north-west outcrops, the 'Ludlow Shales' comprise two distinct geological units (the Lower and Upper Ludlow Shales groups) separated by the Aymestry Limestone (Formation), they are herein treated together from the point of view of their use as a building stone. The 'Shales' are thinly bedded, blue-grey siltstones and **MUDSTONES**, with some **INTERBEDDED** limestones. When weathered, they become a more olive-buff colour and tend to be more fissile in character.

Though not widely used as a building stone in this area, the 'Shales' may have been extracted during the quarrying of the Wenlock Limestone (stratigraphically below the Lower Ludlow Shales Group) and/or the Aymestry Limestone. The 'Upper Ludlow Shales' appear to have provided a more useful building stone, owing to the fact that this group is more flaggy in character and has fewer **CALCAREOUS** beds occurring in the sequence. The 'Ludlow Shales' and Aymestry Limestone can be seen in buildings located close to their outcrops both north and east of Ledbury. In the vicinity of Colwall, Aymestry Limestone has been used only for farm buildings such as those seen in the image below, which was taken at Moorcroft.



## SILURIAN of the Woolhope Dome

The third outcrop of Wenlock and Ludlow 'Series' strata is centred on Woolhope, to the east of Hereford, and exists as a domed inlier known as the 'Woolhope Dome'. The effect of this structure on the Silurian limestones and **SHALES** is clearly evident in the topography. These lithologies have had minimal influence on building stone usage, however; due to the paucity of dwellings in the area.

### *Woolhope Limestone Formation*

#### **Woolhope Limestone**

There is an additional limestone unit lying within the Wenlock 'Series' of the Woolhope Dome, known appropriately as the Woolhope Limestone. Its main value was, again, as a source of lime, but a few isolated dwellings are constructed from it.

The top right image shows a long wall at the Old Rectory in Woolhope which is constructed of Woolhope Limestone.

The middle right image shows nodular Woolhope Limestone in use as a walling stone.

### *Aymestry Limestone Formation*

#### **Aymestry Limestone**

The Aymestry Limestone crops out on the lower slopes of the Woolhope Dome and has been extensively quarried for aggregate at Perton. A positive identification of the limestone in buildings of the area has not been made, however.

The bottom right image shows a cottage located in the vicinity of the Woolhope Dome which makes use of Aymestry Limestone for its large chimney stack, bread oven and boundary wall.



# SILURO-DEVONIAN

## Lower Old Red Sandstone

### PRIDOLI 'SERIES'

#### Downton Group

The Pridoli 'Series' succession of Herefordshire and adjacent parts of Shropshire commences with the distinctive Ludlow Bone Bed (Member). This marks a fundamental change in sedimentation patterns in the area as marginal marine and, ultimately, fully continental depositional environments became established. It is still convenient to refer to the lithologies of the Pridoli 'Series', along with the overlying red mudstones and sandstones of the Lower Devonian, as the 'Lower Old Red Sandstone' despite the fact that much of the succession is neither red nor composed of sandstone.

#### *Downton Castle Sandstone Formation*

#### **Downton Castle Sandstone**

Named after its type area in the north-west of the county, the Downton Castle Sandstone has been used historically both as a freestone and as a tilestone. The formation comprises thin, planar beds of yellow-brown or buff sandstone, with interdigitations of brown-grey siltstones and mudstones. It is this lithological variability which allows the sandstone beds to be split into thin stone tiles, or where the beds are thickest, to be trimmed into regular blocks of freestone.

The sandstone is fairly hard when freshly exposed, but the sand grains are poorly cemented and often separate when exposed to the agents of weathering. The sandstone is up to 20m thick in the Downton area, but is only 5m thick, at most, in the east of the county. The stone is currently being worked from a new exposure at Brakes Farm, just to the north of Downton Castle.

The sandstone has been used in the construction of Downton Castle and Croft Castle, and, owing to its **FERRUGINOUS** brown colouring, can be identified in the fabrics of a number of buildings along its very narrow outcrop in the north-west of the area.

In the east, it has been quarried from several small outcrops near Colwall and Cradley, and used for buildings and walling. A thin band of the sandstone located to the east of Ledbury has been quarried for use in the town, most conspicuously in parts of the church, where its colour contrasts with that of the other locally available building stones.

*The image below shows darker brown, and badly weathered, Downton Castle Sandstone in the central portion of Ledbury Church tower.*

The sandstone also crops out around the margins of the Woolhope Dome. A quarry at Priors Frome was the probable source for the noticeably browner sandstone used in nearby Mordiford.



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## Raglan Mudstone Formation

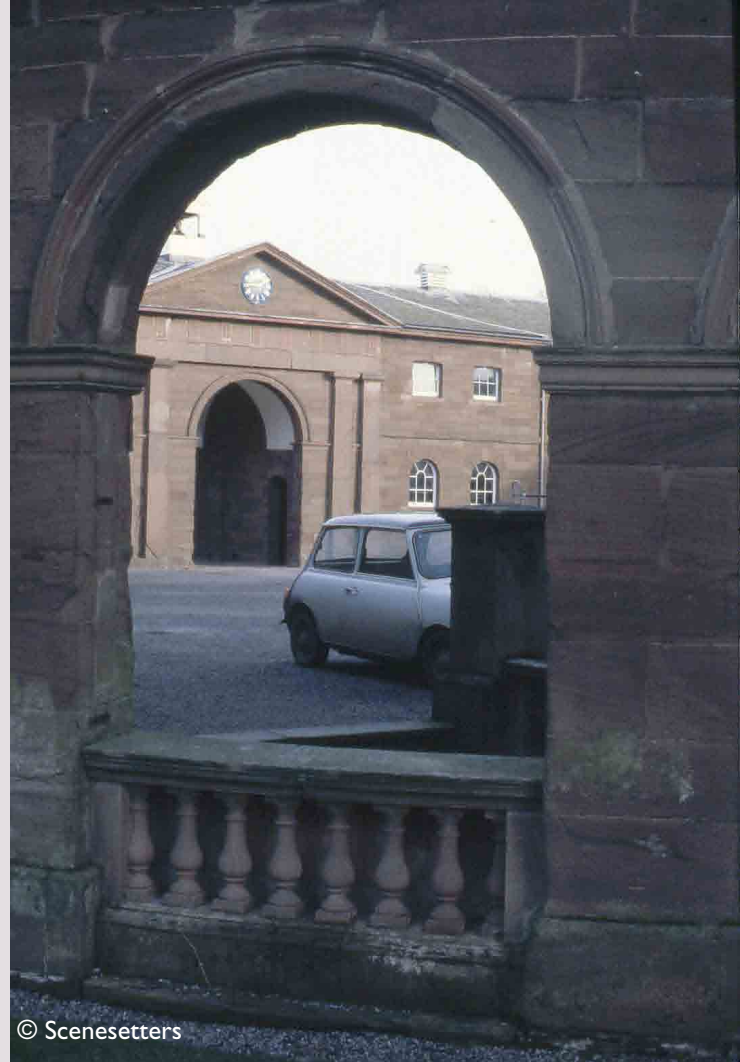
The Raglan Mudstone Formation, which underlies more than half of Herefordshire, marks the onset of fully terrestrial 'Old Red Sandstone' sedimentation. Much of Herefordshire's built heritage has been constructed using stone types worked from this unit. As its name suggests, the formation is predominantly a red mudstone succession, although bands of sandstone occur throughout. In addition, thin nodular, pedogenic limestone bands (i.e. calcareous beds formed in soils and known as 'calcretes') occur sporadically. These are often referred to as 'cornstones' in the historical literature.

The mudstones themselves have been used as a source of clay for the famous Herefordshire brick, tile and pipeworks industries, and many of these sites are documented in a recently published book on brickworks of the county. Some 250 brickworks are listed in the Herefordshire Sites and Monuments Record. The mudstones can also have a high mica content and, as a result, in places they become fissile and flaggy. Many small building stone delves appear to have exploited this lithological variant, though the resultant micaceous (and usually red) slabby stone weathers very badly.

Sandstone beds occur sporadically throughout the formation, but they can be easily recognised in the landscape as their greater resistance to erosion results in the development of obvious topographic features. Many of these sandstones have been exploited for building stone, and they were often worked from small delves which are now mostly overgrown or ploughed out. A good example is provided by Berrington Hall, a classical style late-C18 mansion located between Leominster and Ludlow. The dark purplish-red sandstone, finely cut into ashlar blocks, is remarkably uniform throughout the building. The source of this stone is said to be Shuttocks Hill, found about one kilometre to the north west of the Hall.

The top right image shows Berrington Hall. Raglan Mudstone Formation sandstone was used for the main body of the hall, all outbuildings and trims such as the balusters (which are much more uniform in their dark red-purple colour than is usually the case with this formation).

Three notable bands of stone are mentioned in the literature. All of them have specimens catalogued in the British Building Stone collection housed at the Sedgwick Museum in Cambridge.



## Lyde Stone

This was quarried and used around Pipe and Lyde, just to the north of Hereford. The stone is described as 'drab' coloured.

## Luston Stone

In the Luston area, just north of Leominster, the formerly quarried sandstone is described as a medium-grained, 'drab' and grey mottled rock. Sourced from the Eye Quarries, 'Luston Stone' was used in the villages and hamlets of the local area.

## Withington Stone

Quarried just to the north of Withington (east of Hereford), 'Withington Stone' is unusually coarse-grained. It is described as being brownish-grey, mottled, with rounded **QUARTZ** pebbles and showing obvious **CROSS-BEDDING**. This sandstone was used extensively for buildings in Withington.

The sandstone blocks of Withington Church (image below) vary in colour, ranging from dull grey through warmer colours to pale purples. Such variation is typical of Raglan Mudstone buildings.

It is clear, however, that many other sandstone and siltstone bands were also exploited locally for building purposes wherever they occurred. Despite being known as the 'Black and White Villages', those north-west of Hereford, notably Eardisland, Pembridge, Almeley, Dilwyn, Yarpole and Weobley, all boast some stone buildings. The churches are invariably stone and most exhibit the wide range of lithologies found within the Raglan Mudstone Formation. The coarser, usually white or grey sandstones are commonly used for the **QUOINS** and buttresses. Variably coloured purple, red, cream and striped sandstones are used, frequently at random, for the main walling, while many churches areas are in part constructed of (readily weathered) red micaceous siltstone. **Dilwyn village shows the typical Herefordshire Raglan Mudstone mix with a rather mottled church (weathering badly in parts; top right image), a Victorian school (middle right image), some timber-framed cottages with stone-built gable ends (bottom right image) and stone roadside walls in an otherwise 'Black and White' or brick village.**

The timber-framed houses in these characteristically 'Black and White' villages incorporate varying amounts of local stone. In particular, the sole-plate (bottom-most horizontal beam) usually sits on a sandstone or siltstone plinth, or occasionally on staddle stones, though over the years many of these have been replaced with brick or are concealed beneath a layer of black bitumen. Characteristically, and unsurprisingly, the large external chimney stacks of these buildings are also commonly of local sandstone.



The top right image shows houses on the approach to the classic 'Black and White' village of Eardisland. Stone boundary walls, a large stone chimney stack and a possibly re-built stone-fronted ground floor can be seen.

The third group of stone-built features common to all the villages of north-west Herefordshire in particular, but which is frequently encountered elsewhere also, is represented by the garden, farmyard and churchyard boundary walls. Stone walling is not a feature of the countryside in general, however, where field boundary hedges are the norm.

In Mansel Lacy (lower right image), local sandstone walls appear as soon as the village is entered (and these possibly pre-date the brick-built houses).

### *BISHOP'S FROME LIMESTONE MEMBER*

#### **Bishop's Frome Limestone**

The top of the Raglan Mudstone Formation is marked by the Bishop's Frome Limestone Member. At two to five metres thick, it is more conspicuous and persistent than the minor calcretes or 'cornstones' developed elsewhere within the Raglan Mudstone Formation. Where it crops out, it creates a spring line, and calcareous tufa (see later Quaternary section) often forms.

The limestone itself commonly has a rubbly appearance, with grey-white limestone nodules set within a colourful (red, brown or purple) mudstone matrix. Close to the top of the unit, the limestone nodules often coalesce to the extent that they form a locally continuous limestone bed. It would appear that it is this part of the unit that was quarried for building stone, with the rubbly part being used as lime or aggregate. Bishop's Frome Limestone was seemingly in high demand locally, and it has been mined underground at two separate locations in the county – Credenhill, just west of Hereford, and at Bishop's Frome (the type area of the unit). It tends to have been burnt for lime (and used to 'sweeten' the more acid soils) rather than being used as a building stone.



### *St Maughans Formation*

Lying stratigraphically above the Bishops Frome Limestone is the Early Devonian St Maughans Formation. This unit underlies the Bromyard Plateau of northeastern Herefordshire, the tops of the 'cornstone' hills to the north-west of Hereford, the area to the west of the Golden Valley (and extending up onto the flanks of the Black Mountains), and a roughly east–west trending swathe of land to the south of Hereford. The formation comprises a mix of red-brown, green or purple mudstones, sandstones, **CONGLOMERATES** and calcretes, which are superficially similar to the lithologies of the Raglan Mudstone Formation. Where present, the mudstones have again been used for brick-making. The sandstone bands, meanwhile, have been quarried for flagstone and, where thick enough, for dimension stone. Though not often occurring in continuous bands, the sandstones of the St Maughans Formation are more abundant and thicker than those of the underlying Raglan Mudstone.

These sandstones (and perhaps some of the sandstone bands within the Raglan Mudstone) are the principal sources of Herefordshire stone roofing 'slate'. A small number of quarries still actively work the St Maughans Formation sandstones for building and roofing stone, and there are numerous 'active' permissions in the extreme west of the county in the Golden Valley area.

Both the colour and grain size of those beds suitable for building stone are highly variable. This can be well seen in one of the active quarries within the formation at Tredomen, just over the border in Wales (upper right image). In general, the coarser beds tend towards a pale grey colour and these are the beds most often used for the main quoinstones and buttresses of churches and other large buildings. There are also essentially medium-grained, cream-coloured sandstones which often show stripes of purple-red. The finer-grained sandstones and siltstones are often well laminated but tend to be very soft and easily eroded. Although usually a more uniformly darker red or purple colour, they may occasionally be greenish-grey. Within any one building, therefore, it is not at all unusual to find the full range of stone types, sometimes doubtless indicating different ages of construction, but not necessarily a common source.

Dore Abbey Church (middle image below), representing the core of the C12 abbey, incorporates stone blocks which vary both in colour and quality.

The churchyard wall (bottom right image) includes re-used ridge tiles and other pieces of ornamental stonework.

The image bottom left shows one of the church's internal pillars, which includes blocks exhibiting the 'striping' that is typical of much of the St Maughans Sandstone.





The images to the right, working from top to bottom, show the following:

Houses and farm buildings in Abbeydore, which are mostly of purple and red St Maughans Sandstone.

Further up the Olchon Valley and into the foothills of the Black Mountains, the village of Longtown is largely stone-built, featuring St Maughans Sandstone of a predominantly grey colour. Part of Longtown Castle is built of notably long but thin slabs of grey siltstone.

Longtown school shows the use of red St Maughans Sandstone for the walling, but coarser and harder grey sandstone for the quoins, door and window surrounds.

Older cottages in Longtown are still roofed with flagstones which are representative of the more fissile local sandstones.

## Garnstone

Quarried from the Weobley quarries at Burton Hill, west of Hereford, Garnstone is described as a 'drab', medium-grained sandstone.

## Brownstones Formation

### Brownstones

Southern parts of Herefordshire are characterized by outcrops of the stratigraphically higher beds of the 'Lower Old Red Sandstone', known as the Brownstones. Not only are these pebbly sandstones, as their name suggests, of a red-brown (occasionally chocolate brown) colour, they are of a much more uniform appearance than the underlying 'Lower Old Red Sandstone' formations. Like the rest of the 'Lower Old Red' succession, the sandstones – depending on their suitability – were quarried for both tilestones and dimension stone. 'Active' permissions to work the Brownstones as a building stone remain in place.

Buildings constructed of Brownstones sandstone, ranging from farmhouses to churches, are more likely to be of regularly coursed rubblestone than, say, ashlar blocks.



## Ross Stone

Quarried from the river cliff at Ross-on-Wye, 'Ross Stone' is described as a soft, deep chocolate brown-coloured, medium-grained sandstone. The sandstone features in both garden walls and extensively in the older buildings of Ross-on-Wye e.g. Market House, St Mary's Church and Pye's Almshouses. Hoarwithy, standing above the River Wye to the south of Hereford, is typical in having a significant proportion of Brownstone buildings ranging from the church (seen in the image below) to rows of cottages (right image).

## LATE CARBONIFEROUS–EARLY PERMIAN

### Warwickshire Group

#### *Haffield Breccia Formation*

The Haffield Breccia is a very locally exploited building stone, which has seen use, for example, in the construction of Haffield House, south of Ledbury. It is not used as a dimension stone, but as either roughly dressed blocks or as a rubblestone.



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The rock itself is a very coarse-grained, purple-red breccio-conglomerate containing reworked, angular lithic fragments (from the nearby Neoproterozoic and Lower Palaeozoic successions) set within a sandstone matrix; it was formed by 'flash-flooding' in a desert setting.



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# QUATERNARY

## Tufa

Tufa is a porous carbonate precipitate which often forms on slopes where permeable limestone bands overlie impermeable rock. In Herefordshire, tufas have commonly formed in areas where the Bishop's Frome Limestone is well developed at the top of the Raglan Mudstone Formation. At the limestone–mudstone junction, springs develop and given the carbonate saturated nature of the waters emerging from the limestone, rapid precipitation of calcium carbonate takes place due to the change in physio-chemical environment. Tufas can form on the surfaces of rocks and over vegetation present along spring lines, and also in streams. Fresh tufa is very soft and malleable, but it hardens on exposure to the atmosphere, forming a good workable dimension stone if the deposits are thick enough. The former extent and distribution of tufa in the county is as yet not fully known, but deposits have been worked extensively for use in Norman churches in particular; the classic Herefordshire example being Moccas Church in the Wye Valley. Tufa blocks have been identified in the fabrics of the churches at Aymestrey, Wigmore, Bredwardine, Letton and Lower Brockhampton, in the Bishop's Chapel in Hereford and also in the ruins of Craswell Priory.

The upper right image shows tufa blocks used in the construction of St James' Church, Wigmore.

The lower right image shows the use of tufa inside the Church of St Michael and All Angels, Bodenham.

Sites of active tufa formation are comparatively rare and are of biological, geological and archaeological importance and, as such, should be recorded and protected.



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# Glossary

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

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

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

**Cobbles:** Rounded rock clasts (of any lithology) between 64 mm and 256 mm in size.

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

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

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

**Fossiliferous:** Bearing or containing fossils.

**Igneous:** Rocks formed when molten magma cools and solidifies. It includes extrusive rocks erupted from volcanoes (e.g. basalt) and intrusive rocks that cool beneath the Earth's surface (e.g. granite, gabbro, granodiorite, dolerite).

**Interbedded:** Occurs when beds (layers or rock) of a particular lithology lie between or alternate with beds of a different lithology. For example, sedimentary rocks may be interbedded if there were sea level variations in their sedimentary depositional environment.

**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.

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

**Outcrop:** Area where a rock unit is exposed at the ground surface.

**Quartz:** A crystalline form of silica - silicon dioxide,  $\text{SiO}_2$ .

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

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

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

**Shales:** An argillaceous rock with closely spaced, well-defined laminae.

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

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## Further Reading

Hereford & Worcester Earth Heritage Trust *Explore* building stone trail guides (2003):

Goodrich Castle

Hereford Cathedral

Hereford City Centre (Now contains some errors due to some shop fronts being altered since published.)

Hereford & Worcester Earth Heritage Trust *Explore* geology trail guides (2003):

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