Strategic Stone Study
A Building Stone Atlas of Hertfordshire

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Introduction

Hertfordshire lies to the north of London and is bordered by Bedfordshire to the north, Cambridgeshire to the north-east, Essex to the east, Buckinghamshire to the west and Greater London to the south. Hertfordshire has had a relatively stable history from the point of view of government and administrative boundary changes since the mid-1960s when Barnet Urban districts were transferred to form part of the present-day London Borough of Barnet and the former Potters Bar Urban District of Middlesex was transferred to Hertfordshire. For clarity, Hertfordshire is regarded here as the county area comprising the ten districts of: Broxbourne, Dacorum, East Hertfordshire, Hertsmere, North Hertfordshire, St Albans, Stevenage, Three Rivers, Watford, and Welwyn Hatfield. Despite the spread of built-up areas, much of Hertfordshire is still given over to agriculture.

The rocks of Hertfordshire form part of the large shallow syncline known as the London Basin and they dip in a south-easterly direction becoming progressively younger as one heads in that direction across the county. The oldest strata exposed at the surface in Hertfordshire occur in the north of the county at the foot of the chalk Chiltern Hills near Tring and Ashwell where there is a small strip of Lower Greensand, Gault Clay and Upper Greensand sediments. South of this strip, the Upper Cretaceous Chalk Group is present. Chalk dominates much of the bedrock geology of Hertfordshire and forms the Chiltern Hills. The southern part of the county exposes younger Palaeogene sands and clays belonging mainly to the Upnor, Reading and London Clay formations. During the past 2 million years much of the bedrock geology of Hertfordshire has become covered by the accumulation of fluvial sands, gravels and silts (‘superficial deposits’); the eastern half of the county was affected by glaciers during the last Ice Age which created a thick layer of glacial boulder clays.

Overall, the Cretaceous and Palaeogene successions of Hertfordshire have yielded a limited number of stones suitable for building purposes. Both Chalk Block and Quarry Flint nodules from the Upper Cretaceous have been extensively used in the past for local building purposes. Quartz-cemented sandstones (Sarsen Stones) and Palaeogene conglomeratic beds (Hertfordshire Puddingstone) were also worked for building material and are commonly found in older buildings in the county. Tufa was very locally sourced and employed as an occasional building stone.

There are no building stone quarries currently operating in Hertfordshire. Some quarrying of sand and gravel occurs in the St Albans area and in the past clay has supplied a local brick-making industry which continues today near Hemel Hempstead. The limited availability of indigenous building stone in Hertfordshire has resulted in the extensive use of imported stones across the county.

The stratigraphy and distribution of these rocks and the building stones that are sourced from them are summarised in the maps and stratigraphic chart that follow. The building stones themselves are described under the headings ‘Indigenous’ and ‘Imported’ types and are treated in stratigraphic order. To assist the reader in navigating around the Atlas, entries in the stratigraphic table and the corresponding descriptions are interactively linked (by means of small coloured triangles located in the upper right corner of the relevant pages).

The section of this Atlas summarising the use of stone in Hertfordshire is based on the relevant National Character Areas (NCAs), the boundaries of which are very relevant to the vernacular built heritage and are defined by a combination of local landscape, history, cultural and economic activity, geodiversity and biodiversity. Six NCAs fall wholly or in part within Hertfordshire: the Chilterns (NCA 110), the East Anglian Chalk (NCA 87), the Thames Valley (NCA 115), the Northern Thames Basin (NCA 111), the South Suffolk & North Essex Clayland (NCA 86) and Bedfordshire and Cambridgeshire Claylands (NCA 88).
Hertfordshire Superficial Geology

- **BUILDING STONE SOURCES**

  - **ALLUVIUM** - CLAY, SILT, SANDS AND GRAVEL
  - **BRICKEARTH** - PEAT, CLAYS, SILT AND SAND
  - **HEAD** - SANDS, GRAVELS, SILT, AND CLAY
  - **RIVER TERRACES** - SANDS, GRAVELS AND CLAY
  - **GLACIOFLUVIAL AND GLACIALACUSTRINE DEPOSITS** - SANDS, GRAVELS, SILT AND CLAY
  - **GLACIAL TILLS** - CLAYS, SANDS, GRAVELS, BOULDERS
  - **CLAY-WITH-FLINTS** - SANDS, GRAVELS, CLAY AND SILT

Derived from BGS digital geological mapping at 1:50,000 scale, British Geological Survey © NERC. All rights reserved.
### Table 1. Summary (Interactive) of stratigraphical and building stone names applied to Cretaceous and Cenozoic sediments and sedimentary rocks in Hertfordshire

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<th>EPOCH/PERIOD</th>
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<td>• Quaternary Flint (Field Flint, Brown Field Flint, Clay-with-Flints)</td>
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<td>• False Puddingstone</td>
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<td>PALAEOGENE</td>
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<td>London Clay Formation</td>
<td>• Hertfordshire Puddingstone (Puddingstone, Conglomerate, Mother Stone, Breeder Stone, Witchstone, Hagstone)</td>
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<td>Lambeth Group</td>
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<td>Upnor Formation</td>
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<td>Montrose Group</td>
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<td>UPPER</td>
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<td>Newhaven Chalk Formation</td>
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<td>Zig Zag Chalk Formation</td>
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<td>West Melbury Marly Chalk Formation</td>
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<td>LOWER</td>
<td>Selborne Group</td>
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<td>Lower Greensand Group</td>
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Background and historical context

Hertfordshire covers 1643 km² (634 sq. miles). Despite its relatively small size, the county has over 8000 listed buildings and 190 conservation areas. Its population is now over one million, a threefold increase since the late C19th.

Hertfordshire shares its geology with the adjacent counties. The ‘chalk and clay-with-flints’ landscape of the Chilterns scarp and dip slope dominates the west of the county. The Chalk escarpment extends north-east into Cambridgeshire past Hitchin, Ashwell and Royston. The gently sloping plateau of the dip slope of this area occupies much of the east of the county. The chalky boulder clay extends under much of northern Essex and southern Suffolk. To the south of the Chilterns and the boulder clay of the east of the county lies the Vale of St Albans - part of the Northern Thames Basin. It is underlain by deposits of sands and gravels laid down during the Anglian glaciation (c. 450,000 BP), partly by the Thames (which at that time flowed through the Vale and across Essex) and partly by glacial melt water. To the south of the Vale the land rises towards the Middlesex border. Most of this area is underlain by London Clay with some outcrops of Palaeogene sands and gravels. In the far north of the county, north of Tring and Ashwell, small areas extend from the foot of the chalk scarp into the Gault Clay of the Bedfordshire and Cambridge Claylands. Each of these areas has a significantly different history of settlement, agricultural and economic development, vernacular architecture and building stone use.

Timber was the main material used for construction in Hertfordshire throughout the medieval period. The county lies at the junction of the Essex/East Anglian and Midland styles of timber frame construction. In the east, buildings are usually of box frame construction, sometimes with flamboyant displays of upright timber close studding. In the west, some cruck frame buildings survive. However, most of the buildings have box frames, often with arch braces and wide panels of wattle and daub.

From the C16th timber frame was gradually superseded by brick. Timber frames were often overlain by lath and plaster. The plaster was sometimes given decorative moulding called pargetting, especially in the east of the county. Weatherboard-
There are at least 250 churches in Hertfordshire, including 141 parish churches. They represent the largest body of extant mediaeval stone buildings in the county. Pre-Reformation churches slightly outnumber post Reformation churches. Most of the pre-Reformation churches developed piecemeal over the centuries. These were variously altered, enlarged and added to. They exhibit a mixture of features, fabric and building materials. The few churches that were largely constructed in one period are the result of drastic rebuilding, such as the C14th Church of St. Mary, Ashwell, constructed mainly of types of chalk.

Over 90% of the county’s 102 pre-Reformation churches used Flint in their construction, sometimes with Glacial pebbles and cobbles, Puddingstone and/or imported stone (most commonly Totternhoe Stone). Barnack Stone from Northamptonshire was also occasionally used for dressings.

During the C13th the population grew rapidly. In the east and northeast of the county where the population was the wealthiest, many churches were rebuilt in stone for the first time while others were enlarged. Nearly all their chancels were rebuilt and extended at this time. Many churches were subsequently rebuilt, but their C13th stone chancels were retained.

Increasing prosperity among the surviving merchant class and lesser gentry, and an obsession with intercession partly in response to further outbreaks of the Black Death in the 1360s, led to the enrichment of churches. Most West towers, clerestories or chantry chapels date from the C14th-C15th. The south of the county’s proximity to London and the establishment of many landed country estates led to the remodelling of many churches.

After the Reformation, the use of brick became dominant, though a third of all the churches were built of Flint. Imported stone was used much more frequently than previously, particularly Kentish Ragstone, but also ooidal limestone and (in one instance) Triassic sandstone.

During the C19th many churches were restored, rebuilt or built new, stimulated by the Church Building Society and the Oxford Movement (founded in 1836). The Society funded 36 new churches and the rebuilding of 10 others. After brick, Flint was the most popular material used in new churches in the C19th. Brick or imported stone was generally used for the dressings. Often complex styles of Flint work were introduced. For example, St Paul’s, Langleybury (restored by Woodyer in 1865) has squared and coursed Flint and St Thomas, West Hyde (restored 1844), has circular knapped Flint. Few churches were rebuilt in the economically depressed north and north-east of the county, G.E. Pritchett’s knapped Flint Church of St Mary at Therfield (1878-1911) being a notable exception.

Several Norman castles were built at strategic locations in the county during the C12th. These included Great Berkhamsted, Hertford and Waytemore, Bishop’s Stortford. Flint walls survive at all three, including remains of the curtain wall and octagonal tower at Hertford.
As castles were abandoned, the construction of fortified manors in stone became fashionable. Many were built in Flint with Totternhoe Stone dressing and quoins. Ecclesiastical Manor Houses such as the Old Rectory at Therfield (C15th of Flint rubble with Totternhoe Stone dressings) and Nyn Hall, Redbournbury (C15th) were also built. Occasionally, houses were built entirely from Totternhoe Stone, such as Hinxworth Place (C15th).

Upon the dissolution of the Monasteries, much of the land confiscated by the Crown from St. Albans Abbey passed to courtiers and businessmen, all of whom were keen for status and a retreat from London. As a result, there was a growth in country-house building during the mid-C16th. Between 1540 and 1650, thirty large country or manor houses were built. Nearly all were in brick, though often with stone dressings, such as at Hatfield House (1607-12), Knebworth House (C16th – though only one wing survives), and Old Gorhambury (1536) for Francis Bacon.

Country-house building took place in waves, pre-1580 and between the 1640s and 1660. Much improvement was undertaken between 1680 and 1720. A further building boom took place between 1750 and 1780. From the mid-C18th stone became fashionable for the re-building or construction of new, large houses. Classical early brick buildings such as Moor Park were encased in Portland Stone (1720-8).

The proximity of London to the south led to extensive suburban development in the southern part of Hertfordshire during the C20th. New towns were built at Letchworth (1903), Welwyn Garden City (1920), Hatfield, Hemel Hempstead and Stevenage. The southern border of the county lies only 25-30 km from central London. A significant number of Arts and Crafts Movement houses were constructed in Hertfordshire particularly in the Chilterns area and at Letchworth. Some use was made of imported stone for dressings. Charles Voysey used imported Westmorland Slate roofs and stone dressings for a cluster of houses near Chorleywood, including Hollybank and his own home, The Orchard.

Chiltern Hills

The eastern part of the Chiltern Hills falls within Hertfordshire, and they cover much of western Hertfordshire, stretching east to Stevenage and south to St Albans and Chorleywood. The area is characterised by the more dissected Clay-with-Flints plateau of the Chilterns dip slope. Through valleys are characteristic of the Chilterns in Hertfordshire. Major transport routes radiating from London have followed the valleys from prehistory.
These facilitated the transportation of stone into the county from Bedfordshire and Buckinghamshire and from areas further afield once the canal and railway network developed.

The Chilterns produced limited quantities of five main types of local stone: Chalk, Quarry Flint and Quaternary Flint, Sarsen Stone and Puddingstone. Timber framing with thatched roofing was dominant in the mediaeval period. Flint was the most widely used stone. It is found in nearly all the pre-Reformation churches of the area and in a wide range of buildings, from town houses to barns.

Close to the scarp, Totternhoe Stone or Chalk Block was occasionally used, usually with Flint such as at the Church of St. Mary, Pirton (C12th) and the Church of St. Peter and St. Paul, Tring (C13th). There are several stone buildings in Pirton: Rectory Farm (C17th) is of chalk with red brick and rendered timber framing whereas Old Hall is built of Flint with brick quoins and stone dressings.

Sometimes, Sarsen Stone or Hertfordshire Puddingstone was used for foundation blocks or for cornerstones, such as in the Church of St. Lawrence, Nettleden, the Church of St. Peter and St. Paul, Little Gaddesden and the Church of the Holy Cross, Sarratt. At Westbrook Hay, there is a folly house built of Hertfordshire Puddingstone.

Ashridge House in Little Gaddesden, was built of Totternhoe Stone in 1808 by James Wyatt for the Earl of Bridgewater.

Timber framing, often with weatherboarding, was used for barns and other farm buildings such as hay barns, cart and implement sheds, granaries and livestock housing. They were often built on brick bases and sometimes incorporated Sarsen Stone in the footings. In conjunction with brick, Flint came to be the dominant building material of the area from the C18th.

The C19th expansion of the railway network led to a rapid growth in population. A large number of Anglican Churches were built or rebuilt to serve the increased population. These were largely constructed of local Flint, often with imported stone dressings. Non-conformism became established early in the Chilterns. There is a particularly rich legacy of C18th and C19th chapels.

Brick was produced locally from the C15th becoming the dominant building material of the area from the C18th. It remains in production today at Bovingdon. Chilterns Flint was commonly used in combination with brick. Welsh Slate became commonplace during the C19th as a result of improved transportation, in particular by the construction of turnpikes, the Grand Junction Canal and the railway system.

**East Anglian Chalk**

The East Anglian Chalk of Bedfordshire, Cambridgeshire, Hertfordshire, Suffolk and north-west Essex is part of the narrow ridge of chalk that runs NE-SW across southern England from Devon to Lincolnshire. The chalk ridge forms the highest land in Hertfordshire. It runs from Tring in the west past Hitchin, Baldock, Ashwell and Royston and east into north west Essex and Cambridgeshire.

The area was historically sparsely populated. Scarp foot springs emerge from the outcrop of Totternhoe Stone which overlies the less permeable West Melbury Marly Chalk Formation. Settlements such as Ashwell, Hitchin, Norton and Royston became established on the spring line.

The area’s buildings made use of a mixture of materials: timber frame, red and gault brick, Flint and Chalk with thatched and tiled roofs. Timber frame houses are in the East Anglian tradition with close boarding. They are often rendered, and pargetting is commonplace. Brick started to be used from the
C16th. Buildings were frequently re-clad using brick during the C17th and early C18th, as is evident in settlements such as Baldock, Royston and Ashwell and the surrounding villages.

Chalk and Totternhoe Stone were used for buildings, from the magnificent Church of St. Mary, Ashwell, to more prosaic uses in the Village Lock-up and garden walls. Hinxworth Place, one of the best C15th-C16th stone manor houses in Hertfordshire is built of Totternhoe Stone. A few Chalk buildings survive in the towns, such as number 48a in Kneesworth Street, Royston.

Flint was used in the pre-Reformation churches with Chalk, Totternhoe Stone dressings and brick. The Knights Templar Church of St. Mary, Baldock (C13th-C15th) exhibits Flint and stone chequerwork. The Church of St. John the Baptist, Royston, the only surviving part of a former Augustinian Priory, is built of Flint with Chalk Block and Totternhoe Stone. Knapped Flint was often used in the area for walling, commonly with brick, or sometimes mixed with Chalk Block or Bat and Cob, such as in Ashwell and Royston. Parts of the mediaeval Flint walling of Royston Priory survive. Some buildings were built in Flint during the C19th such as the School at Fish Hill in Royston.

Clay Bat buildings are mainly found in the East Anglian Chalk area to the north east of the county, particularly on the border with Cambridgeshire. Clay Bat is made from a mixture of clay, chalk and straw moulded into blocks and allowed to dry in the sun. Clay Bat is the local Hertfordshire name; ‘Clay Lump’ is commonly used as the name for the same material in East Anglia.

Buildings were usually lime rendered, although more prestigious buildings were sometimes stuccoed. Sometimes the buildings are fronted by brick elevations while the remaining walls are in bat. In Ashwell, for example, apparently brick built terraced cottages and houses are only fronted in brick to the street elevation. The remaining walls are of Clay Bat.

There are a significant number of Clay Bat buildings dating to the C19th in Ashwell. They range from small cottages to quite large houses such as Westbury House and include industrial buildings such as Pages Brewery (now the village hall), the Slaughterhouse and Six Bells Clubroom.
Chalk Cob

Chalk Cob is a mixture of Clay, Chalk and straw similar to Clay Bat but the structures made of this material are constructed ‘monolithically’. Walls are built ‘wet’ by raising in stages when the bottom layer is dry enough to hold the next. Few Cob buildings and walls survive in the county. However, it was used quite extensively during the mediaeval period. Significant Cob structures survive at Ashwell. Here, it is used in village walls and in a few buildings, including for the upper storey of a cottage with a brick ground floor.

Cob, Clay Bat and Chalk were quite frequently employed together. For example, village walls in Ashwell are constructed of such a mixture, with a thatched or tiled hat and brick or Flint plinth.

Thames Valley

A small area of Hertfordshire, the Lower Colne Valley to the south of Rickmansworth, Maple Cross and Chorleywood, falls within the Thames Valley NCA. C20th development has been extensive in the area and substantial gravel extraction has taken place in the lower part of the valley.

Timber frame was once dominant with brick used generally from the late C17th onwards. Rickmansworth has a good selection of C16th-C17th houses and cottages, including the Old Vicarage and the Priory. They were mostly re-fronted in brick during the C18th-C19th. Granite, probably imported from south west England, was used for kerbing in the town.

Flint was often used in the plinths to timber frame and brick buildings. It was extensively used in pre-Reformation churches and those restored, rebuilt and built during the C19th and early C20th. St. Peter’s Church, Rickmansworth (1875) is built of knapped Flint with Bath Stone dressings. Our Lady Help of Christians Roman Catholic Church (1909) was built in concrete but faced with Field Flint and stone dressings.

Mansions with parks were common in the wider Thames Valley NCA. Those in Hertfordshire are generally built of brick with stone dressings and they boast classical features such as stone porticoes (e.g. as at Horn Hill Court and Newland Park).
Northern Thames Basin

This area extends from Hertfordshire in the west to the Essex coast in the east. The area takes in the south of Hertfordshire including the suburbs of north London and historic towns and cities such as St. Albans, Hatfield, Welwyn, Hoddesdon and Cheshunt, along with the C20th new and extended towns of Welwyn Garden City and Hatfield. The eastern boundary with Essex is formed by the River Lea. The major towns are located in the valleys and along the valley sides of the Ver, Upper Colne and Lea.

There is good survival of mediaeval timber-framed houses in both the towns and countryside (including significant numbers of farm buildings and barns). The towns have many C16th-C17th timber-framed buildings. They were often re-fronted in brick during the C18th when brick became dominant.

During the C16th-C17th, the increasing influence of London led to the growth of market towns and substantial farming estates and prompted the construction of many country houses. Brick became dominant from the late C17th. The construction of railways stimulated both the development of commuter settlements and the expansion of existing towns and villages during the C19th and C20th. Welwyn Garden City (1920) and Hatfield new town (1946) also expanded development further during the C20th. Some imported stone was used for the dressings of buildings in the civic area of the former.

Stone has been used in the area from the Roman period. The Roman City of Verulamium (now St. Albans) used Flint as its main building material (together with Totternhoe Stone and brick). Materials from the city were reused in St. Albans Abbey (which dates from the Norman period). Flint was used in Hertford Castle and extensively in the area’s pre-Reformation churches. It was often mixed with other materials such as Chalk, Totternhoe Stone, Puddingstone and Glacial pebbles and cobbles. Flint was used for buildings and walling in much of the area.

Chalk Block was also occasionally used, for example in Ver Cottage in St. Albans (1831) although unfortunately this building is now rendered. Puddingstone is found in small qualities in many pre-Reformation churches in the area. The stone was often used for foundations such as in the C12th
Church of St. Mary, Hemel Hempstead. Small blocks are often found in churches, including St. Michael’s and St. Stephen’s churches in St Albans. False Puddingstone blocks occur in several churches in the area, including in the rubble wailing of the Church of St. Mary, Aldenham, the Church of St. Mary, North Mimms and the Church of St. Giles, South Mimms.

Sarsen Stone was used occasionally for example in the Church of St. Mary, Hemel Hempstead, the Minsden Chapel, the Church of St. Mary, North Mimms, and the churches of St. Michael and St. Stephens in St. Albans. In the Church of St. John the Baptist, Aldenham, dressed Puddingstone blocks were used in the tower; these were possibly sourced from a pit at nearby Radlett.

During the C19th, several churches were constructed, rebuilt or restored. Although many used Flint with brick or imported stone dressings, some were built entirely of imported stone. The Church of St. Peter, Bushey and its adjacent church hall were built in rock-faced Kentish Ragstone (1891 and 1911) and the Church of All Saints, Hertford (1895-1905) was built of Triassic Runcorn Stone from Cheshire.

South Suffolk & North Essex Clayland

This chalky boulder clay plateau area stretches from Stevenage and Bishop’s Stortford eastwards to the county boundaries with Essex and Cambridgeshire. Its northern boundary is formed by the East Anglian Chalklands and its southern boundary by the River Lea between Hertford and Roydon and the River Stort. Settlements within this include Bishop’s Stortford, Barkway, Buntingford, Walkern, Much Hadham, The Pelhams, Stevenage and Sawbridgeworth and Watton-at-Stone.

Timber was the main building material of this area and significant numbers of late medieval timber-framed buildings survive. They include large manors such as Balhams Hall, High Cross (C15th), barns such as the aised barn at Shingle Hall (C14th-C15th), houses, inns and small cottages. Pargetting is a characteristic of many of the buildings of the settlements in the area. Thatch and clay tile were the dominant roofing materials until slate became more widely available during the C19th.

Flint is the main indigenous stone that has been used for building in the area. The C12th bailey walls to Hertford Castle were built almost entirely of uncoursed rubble Flint. The majority of the pre-Reformation churches of the area are also constructed of Flint. Flint walls are a feature of the settlements of Great Amwell, Anstey, High Wych and the Hadham Road approach to Bishop’s Stortford. Rounded Flint pebbles were often used as a paving and surfacing material. There are excellent examples in Much Hadham High Street and in many other villages.

Flint continued to be used throughout the mediaeval period up until the C17th in vernacular buildings, as uncoursed rubble walling and frequently as the foundation base or plinth of timber-framed structures or early brick buildings. During the C18th and C19th, Flint was frequently used for cottages, for example in Anstey, Westmill, Hamels, Ardeley, High Wych and Great Amwell, and for outbuildings, gazebos and grottos, such as Scott’s Grotto in Ware - the largest subterranean grotto in England.

The C10th Church of St. Michael, St. Albans, is constructed mainly from Flint and Roman tiles with some Totternhoe Stone, Hertfordshire Puddingstone, Bath Stone and possibly Ham Hill Stone.

The area has a long history of stone importation. Totternhoe Stone from Bedfordshire was particularly used in churches built by St. Albans Abbey, such as St. Michaels, St. Peters and St. Stephens in St. Albans. The stone was also used in lay buildings such as Kingsbury Manor in St. Albans. The Eleanor Cross in Cheshunt (1291) is built of Caen Stone and blocks of Carboniferous sandstone were used in the Clock Tower in St. Albans (constructed in 1403-1412).

Imported stone became more readily available following the construction of canals, the Lea Navigation and railways during the C18th-C19th. Imported stone was used for civic and commercial buildings such as Bath Stone for Hertford’s Corn Exchange (1857), Mansfield Red Stone for the dressings of the National Westminster Bank in St Peter’s Street, St. Albans (late C19th) and Portland Stone for St. Albans’ Town Hall (1826) and Haileybury College in Hertford Heath (1809).
Many of the churches constructed during the C19th were also of Flint with brick and/or stone dressings such as the Church of St. James, High Wych (1862). Imported stone was often used for dressings in the restoration works to churches. For example, Bath Stone was used as dressings in the Church of St. Mary, Gilston.

Puddingstone was often used as foundation blocks to church towers, as in the Church of St. Mary, Bent Pelham (C14th-C15th), St. Mary’s, Stocking Pelham (C14th), and St. Nicholas’, Great Munden (C12th). It was also used as the base to the War Memorial at Brent Pelham and is found in boundary walls at Hadham Cross, Much Hadham.

Blocks of False Puddingstone are found in the walls of the Church of St. Leonard, Bengeo (C12th) and in the footings of the Church of St. Nicholas, Great Munden (C12th-C15th), All Saints, Little Munden (C12th) and Great St Nicholas, Sawbridgeworth (C14th). Sarsen Stone was used occasionally such as at the Church of a St Andrew, Much Hadham (C13th-C14th) and St Nicholas, Great Munden.

Roman brick was used in some Anglo-Saxon churches such as the Church of St. Andrew, Hadham (C11th). Brick became dominant for larger houses from the C16th. A good example is the C16th Furneux Pelham Hall. By the C17th, brick was used more widely, in farm buildings, such as the spectacular 140-foot long barn at Upp Hall, Braughing, and in most houses and cottages. Only three churches were built in the county in C17th-C18th. All were built in brick, such as the Church of St. Peter, Buntingford (1614-1626).

Stone was imported from a relatively early date. For example, Wards Hospital (almshouses) in Buntingford (1684) is built of brick with Portland Stone dressings. During the C19th, new mansions were occasionally constructed of stone, for example Gilstone Park was built of coursed limestone rubble with ashlar chimneys (1852).
Bedfordshire and Cambridgeshire Claylands

The Claylands occupy a very small part of Hertfordshire, where the administrative boundary projects northwards from Tring into the Vale of Aylesbury in Buckinghamshire. Settlement is sparse, being restricted to moated farms and isolated properties. Box timber framing, often with arch braces, was dominant in the area during the mediaeval period. Timber framing continued to be dominant for farm buildings into the C19th, often with weatherboarding and thatch or clay tiles. Brick became the dominant building material from the C18th. Many timber framed houses and cottages were then refaced in brick. There are significant numbers of Rothschild Estate brick and tile cottages in villages such as Wilstone.

Flint was used for both of the pre-Reformation churches of St. Mary in Puttenham (C14th-C15th) and in knapped form in C19th churches such as the Church of St. Cross at in Wilstone. St Mary’s Church, Puttenham has a distinctive Flint and Ketton Stone chequerwork. The Portland Stone component was probably sourced from Jurassic outliers of the Mid Vale Ridge of Oxfordshire, or from near Quainton or Stone in Buckinghamshire.

The infrastructure of the Grand Union Canal (1802) is a significant feature of the area. There are four substantial balancing reservoirs that lie at the base of the Chiltern foothills. They served the adjacent main course and the Wendover and Aylesbury Arms of the canal. The canal’s associated structures made some use of building stone, in particular Millstone Grit Sandstone, though brick is dominant.
Stones in walls

Hertfordshire’s built heritage displays a diverse range of stones and styles of usage in walls. Representative examples involving indigenous building stones of the county are illustrated on the following pages.

Roughly dressed blocks of Tufa with random Quaternary Flint pebbles, Church of St. Ippolyts, St. Ippolyts

Details of dressed block of Tufa showing porous structure, Church of St. Ippolyts, St. Ippolyts

Block of False Puddingstone with Quaternary Flint pebbles and cobbles in wall of Church of St. Ippolyts, St. Ippolyts

Glacial pebbles and cobbles, Church of St. Nicholas, Hinxworth

Detail of Glacial pebbles and cobbles, Church of St. Nicholas, Hinxworth
Block of Hertfordshire Puddingstone in wall of the Church of the Holy Cross, Sarratt

Decorative use of Totternhoe Stone in the roof of the Abbey Gatehouse, St. Albans

Detail of block of Hertfordshire Puddingstone, St. Michael’s Mill, St. Albans

Totternhoe Stone ashlar blocks, Ashridge House

Squared and dressed blocks of Hitchin Carstone, Church of St. Mary, Hitchin

Squared Chalk Block in wall of the Church of St. Mary, Ashwell

Detail of squared blocks of Hitchin Carstone, Church of St. Mary, Hitchin
Quaternary Flint pebbles in Castle walls and Gate, Hertford

Knapped Flint nodules in walls of the Old School House, Wheathampstead

Mixture of irregular Quaternary Flint pebbles, knapped Quarry Flint, Hertfordshire Puddingstone and Roman tiles in nave walls of St. Albans Cathedral

Large knapped Quarry Flint nodules in wall of Church of St. Mary, Hitchin

Decorative Quarry Flint, Ancaster Stone and Bath Stone in Verulamium Lodge, St. Albans

Chequerwork of knapped Quarry Flint and Totternhoe Stone, Thunderdell Lodge, Ashwell
The Church of St. Mary, Hitchin has C12th origins but much of the remaining structure dates from the C14th and C15th. An extensive range of stones feature in the external walls including Chalk Block, Totternhoe Stone, Quarry Flint, Quaternary Flint, Glacial pebbles and cobbles and Hitchin Carstone with later (likely Victorian) additions of Ancaster Stone, Bath Stone and Permo-Triassic Sandstone.

**Lower Cretaceous**

**Selborne Group**

**Gault Formation (with basal ‘Junction Beds’)**

**Hitchin Carstone**

Hitchin Carstone is a new name applied here to a distinct medium-to coarse-grained, ferruginous sandstone which varies in colour from dark olive-brown to purplish-black; irregular, ochreous patches and mottling are commonplace. The overall appearance of the stone is quite ‘gritty’ or granular, and small (<2mm) rounded clasts of pale quartz, feldspar or phosphatic material are evident in many blocks. The stone does not obviously contain fossils, but indistinct traces of lamination or low-angle cross-beddings are sometimes apparent.

The geographical origins of Hitchin Carstone are not known but the lithological characteristics and appearance of the stone point to a source within the so-called ‘Junction Beds’. Stratigraphically, the ‘Junction Beds’ occur at the base of the Gault Formation and immediately overlie the Woburn Sands Formation in the Hitchin district. Hitchin Carstone is best seen in the west tower and south-west walls of the Church of St Mary, Hitchin.
The Upper Cretaceous Chalk Group forms the bedrock geology to most of central, northern and western Hertfordshire. The Chalk Group succession attains a total thickness of approximately 300m and is divided into a thinner lower unit (the Grey Chalk Subgroup, or ‘Lower Chalk’, which has a relatively high clay content and contains marls but no Flint) and a thicker upper unit (the White Chalk Subgroup, or ‘Middle and Upper Chalk’, which comprises nearly pure chalk and contains abundant Flint).

**Chalk Group – Grey Chalk Subgroup**

**West Melbury Marly Chalk Formation (Cambridge Greensand Member)**

Cambridge Greensand pebbles and cobbles

Former coprolite workings in the Cambridge Greensand Member near Ashwell yielded rounded and angular pebbles and small boulders of various rock types including granite, schist, hornfels basalt, sandstone, greywacke, slate and dolomitic limestone. Some of these ‘exotic’ pebbles and cobbles were used for building purposes and feature in the walls of the churches at Ashwell and Hinwworth.

**Zig Zag Chalk Formation (Totternhoe Stone Member)**

Totternhoe Stone

The Totternhoe Stone Member varies in thickness from <0.5m in the Hitchin area to 1-2m elsewhere; locally it may reach up to 5-6m, but the base and top of the unit may grade into the adjoining chalk deposits and thus the boundaries can be difficult to recognise. Totternhoe Stone is a distinctly harder unit of chalk within the Grey Chalk Subgroup and typically comprises fine-grained, creamy to pale brownish-grey, chalky calcarenites. It often appears ‘sandy’ due to the presence of coarse fossil fragments. The unit varies from thin to thickly bedded and is phosphatic in parts; some beds contain characteristic dark brown phosphatic pellets up to a few mm across, which occasionally become nodular and attain sizes of several cm across.

The use of indigenous Totternhoe Stone in Hertfordshire was quite limited. The stone was worked in the county at Ashwell Quarry and near Barkway. Churches located close to the outcrop, such as the Church of St. Mary, Pirton (C12th) and the Church of St. Peter and St. Paul, Tring (C13th), made much use of Totternhoe Stone. It was also employed in chequerboard work (with Quarry Flint) at Thunderdell Lodge near Ashridge.

Totternhoe Stone imported from Bedfordshire has been employed for tracery and other decorative purposes from the Saxon period onwards and examples of its use in this way are provided by a substantial number of churches across the county which date from the C12th. These included the Church of the Holy Cross, Sarratt, St. Andrew’s, Abbott’s Langley and St Mary’s, Kings Walden. However, what is undoubtedly the most impressive and extensive use of Totternhoe Stone in Hertfordshire is seen at Ashridge House.
Chalk Group - White Chalk Subgroup

Chalk (Chalk Block, Clunch)

The white chalky limestones of the Upper Cretaceous White Chalk Subgroup are amongst the most distinctive and easily recognised building stones employed in Hertfordshire. They are white to very pale grey, typically structureless limestones, which in places contain fossil oysters (inoceramids) and echinoids, and occasionally crinoids, brachiopods and belemnites.

Melbourn Rock (or Wellbury Rock) is a hard variety of chalk which is off-white in colour and exhibits a blocky, fractured texture. It is typically associated with thin marl bands. The Melbourn Rock Member ranges in thickness from about 3m in the Chiltern Hills area to between 2 and 7m thick around Hitchin. It can be difficult to distinguish from other Chalk Block when employed as a building stone, but its use is likely relatively limited in Hertfordshire. Records indicate that it was used in the Church of St. Mary, Ashwell.

Chalk is generally unsuitable for exterior stone-work as weathering (including repeated wetting and drying) coupled with frost action, causes the relatively soft rock to powder and disintegrate into small angular brash. Softer forms of the stone, when used externally, may show concave weathering away from mortar lines.

Quarrying and mining for Chalk and Flint have a long history in the county. There are a considerable number of mediaeval to C19th quarries in the north of the county. The mining of Chalk was particularly common from the C18th to the C20th, usually for agricultural lime and lime mortar and for use in the production of bricks, tiles and pottery. It was also occasionally used for building stone, mainly for building foundations and for decorative work, but also to make compacted chalk floors.

Chalk is typically used as a rough walling stone (often accompanying other stone types, especially Flint) or for decorative purposes (window dressings or banding etc.). The stone may be roughly cut, which has enabled the creation of areas of squared blockwork. Occasionally, houses were built entirely of Chalk Block such as Hinxworth Place (C15th). Chalk was also employed in some lesser buildings such as the ‘Village Lock-Up’ in Ashwell and for village boundary walls. Away from the main outcrop, walls constructed entirely of Chalk Block are rare; one former example in St Albans (Ver Cottage) has now sadly been completely rendered over.

Noteworthy examples of the use of Chalk include the Church of St. Mary, Reed, St. Bartholomew, Wigginton, St. Mary’s, Ashwell, the Drinking Fountain in Old Cross, Hertford and the Church of St. Mary, Hitchin.
Melbourn Rock (or Wellbury Rock) is a hard variety of chalk which is off-white in colour and exhibits a blocky, fractured texture. It is typically associated with thin marl bands. The Melbourn Rock Member ranges in thickness from about 3m in the Chiltern Hills area to between 2 and 7m thick around Hitchin. It can be difficult to distinguish from Chalk Block, but its use as a building stone is considered to be relatively limited in Hertfordshire. Records indicate that it was employed in the construction of St. Mary’s Church in Ashwell.

Quarry Flint (Fresh Flint)

Quarry Flint is one of the most common and widely used building stones in Hertfordshire. It originates from bands and more isolated nodules of Flint that occur within the chalky limestone beds of the White Chalk Subgroup.

Quarry Flint is an extremely fine-grained (cryptocrystalline) and hard form of silica containing microscopic, quartz-crystal aggregates. It usually occurs as irregularly-shaped nodules that are 10-20 cm across, or as (sub-)rounded pebbles and cobbles; occasionally, it is also found as weakly banded tabular sheets or layers up to 20 cm thick. The colour is very distinctive; fresh Flint nodules have a white outer cortex with a black or dark grey interior. Quarry Flint breaks with a characteristic conchoidal fracture, producing razor-sharp, fine edges; the cleaved surfaces may exhibit banding resulting from the alternation of layers of slightly different composition. Flint nodules may contain cavities lined with translucent botryoidal chalcedony or small transparent quartz crystals. Some Flint nodules contain well preserved fossils, with echinoids, sponges, bivalves and burrow-structures being the most commonly encountered types.

The use of Quarry Flint was particularly prevalent in the Chilterns, East Anglian Chalk, northern Thames Basin and Thames Valley areas of the county. It was extensively used in building and village walls throughout much of Hertfordshire in a wide variety of ways, including as knapped, faced, trimmed or ‘cleaved-faced’ stone and in squared chequerwork. It is occasionally found coursed in church walls.

The extremely hard and resistant nature of Quarry Flint-type nodules has resulted in them having been recycled by natural processes into younger deposits. These reworked types of Flint, which show specific characteristics, are described in the Quaternary section of this Atlas below.

Quarry Flint and Quaternary Flint are often the main components of the rubble walling of pre-Reformation churches in Hertfordshire. Other stone types featuring alongside the Flint include Chalk, Hertfordshire Puddingstone, Sarsen Stone and Glacial pebbles and cobbles.

After the Reformation, a third of all churches were built mainly of Flint. During the C19th, 46 new or reconstructed churches were built in the county, often using Flint with either brick or imported stone dressings. Complex styles of Flint work were introduced. For example, the Church of St. Paul, Langleybury (1865) has squared and coursed Flint and the Church of St. Thomas, West Hyde (1844) has circular knapped Flint.

The stone was employed in fine medieval and early post-medieval houses such as Old Gorhambury (1560) and Berkhamsted Place (c.1580). It was also used in many villages for general walling and for farm buildings.

Other examples of the use of Quarry Flint can be seen at the Church of St Mary, Ashwell, Thunderdell Lodge, Ashridge (in chequerwork with Totternhoe Stone), St Mary’s, Reed, The Old School, Wheathampstead, St Mary’s, Hitchin (very large nodules up to 20cm across), St John the Baptist, Aldbury and the Abbey Gate and the Lodge House to the Roman Theatre of Verulamium at St Albans.
Hertfordshire Puddingstone (Puddingstone, Conglomerate, Mother Stone, Breeder Stone, Witch Stone, Hagstone)

Hertfordshire Puddingstone is one of the best known and most distinctive stone types that has seen use in the county. It is a conglomerate containing sub-rounded pebbles of Flint which mainly exhibit grey interiors but may be stained by various iron compounds to produce attractive hues of red, orange or (occasionally) green. The size of the pebbles varies considerably even within a single block of Puddingstone, but they typically range from 1-10cm; however, much larger cobbles do sometimes occur. The pebbles are cemented by relatively uniform pale grey or buff quartz. Overall, Hertfordshire Puddingstone is a hard, coherent and durable rock that tends to break in a regular, planar manner both around and through pebbles. Synthetic concrete may resemble Puddingstone but it fractures unevenly.

Hertfordshire Puddingstone was evidently a popular building stone and it can be encountered in a range of buildings and walls, although it is rarely the main constituent of a structure. Examples of its use include the archway to Home Farm at Battlers Green near Aldenham, the war memorials at Latimer and Brent Pelham, the garden walls at West Radlett, the entrances to the Icehouse, grotto and rock garden at Ashridge House and as scattered blocks in the wall of St. Andrew’s Street car park in Hertford. It was often used for wheel guards to buildings and for mounting blocks.

It occurs as roughly dressed blocks in the walls of many pre-Reformation churches in the county including the St John the Baptist, Aldenham, St Michael’s, St Albans, and Holy Cross, Sarratt. Hertfordshire Puddingstone is also used as a foundation stone for church walls and buttresses at St Lawrence, Nettleden, St John the Baptist, Great Gaddesden and St Peter and St Paul, Little Gaddesden.

Large isolated blocks of Hertfordshire Puddingstone can be seen in St Albans at Kingsbury Mill, St Michael’s Street, in the Castle Grounds outside the Museum in Hertford and in the Priory Garden, Ware. They also occur at Berkhamsted and in villages such as Brent Pelham, Furneux Pelham, Standon, Much Hadham, Little Hadham and Bishops Stortford.
False Puddingstone is the name given to breccio-conglomerates that have an overall deep purple to red or deep brownish colouration and contain a mixture of sub-rounded dark reddish-grey Flint pebbles, angular, orange-brown clasts and flakes of Flint and chert and whitish quartzite pebbles. It is readily distinguished from Hertfordshire Puddingstone by its overall darker colour and deep red-purple iron-rich cement (see image on page 15).

False Puddingstone is a relatively hard, durable rock but has a sporadic occurrence and is rarely encountered. It can be found in the walls of 14 churches across the county. Sites include the rubble walling of churches of St John the Baptist, Aldenham, St Mary’s, North Mimms (C14th), St Giles, South Mimms (C14th-C15th), St Leonard’s, Bengeo (C12th) and St Ippolyts (see section below on Tufa). It was also used in the footings to churches including those St Nicholas, Great Munden (C12th-C15th, All Saints’, Little Munden (C12th) and Great St Nicholas, Sawbridgeworth (C14th).

Sarsen Stone (Silcrete)

Sarsen Stones typically occur as rounded or elongate pebbles, cobbles, boulders or even metre-scale isolated slabs (up to 2m in length). They are grey to pale brown in colour, becoming distinctly creamy-buff when weathered, and possess a very fine-grained saccaroidal (‘sugary’) texture comprising sub-rounded quartz grains set within a silica matrix which is visible on fractured surfaces. Sarsen Stones are very hard and resistant to weathering. Their surfaces are often smooth and may occasionally show poorly-defined bedding structures.

Sarsen occurs less frequently in pre-Reformation churches than Puddingstone but has a widespread distribution across the county. Churches where it does occur include Holy Cross, Sarratt and Great St Mary, Sawbridgeworth, St Mary’s, Hemel Hempstead, the ruined Minsden Chapel, St Mary’s, North Mimms, and St Michael’s and St Stephen’s in St. Albans. It can also be seen in the churches of St Mary, Watton-at-Stone, St Catherine, Sacombe, St Lawrence, Bovingdon and St Margaret of Antioch, Bygrave.

During the C19th, Walters Ash quarries in Buckinghamshire acted as a source of dressed Sarsen Stone. The stone from this site was used for the dressings to the buttresses of Christ Church, Chorleywood (1869-70).

Quaternary Flint (Field Flint, Brown Field Flint, Clay-with-Flints)

Its widespread availability, combined with its hardness and resistance to weathering, has resulted in Quaternary Flint being one of the most dominant types of building stone used in Hertfordshire. Many walls and buildings (especially those of churches) throughout the county employ Quaternary Flint in one form or another, and the stone has been used extensively in many towns and villages.

Quaternary Flint typically occurs as irregularly-shaped nodules which are found lying on the surfaces of fields or within deposits of ‘Clay-with-Flints’, or as pebbles within river terrace gravels and other superficial deposits. The size of the nodules ranges from 10-30 cm, although larger nodules occasionally occur. The colour is variable; less weathered Flint nodules or pebbles have a cream outer cortex with darker coloured (greyish) interior; weathered Flints, in contrast, or those that have lain in soil or superficial deposits for a long period of time may be variously discoloured or bleached, and often have brown stained interiors due to the precipitation of iron hydroxides from percolating ferruginous waters. This ‘weathered’ appearance helps distinguish Field Flint from the much ‘fresher-looking’ Quarry Flint.

As a walling stone, Quaternary Flint was employed in a wide variety of ways: as nodules or pebbles laid roughly to course; as squared blocks as part of chequer-work; as knapped, faced,
trimmed or cleaved faced stone in random or decorative arrangements. Nodules were often selected for their shape and size and laid in either a random or coursed manner.

Several Norman castles were built at strategic locations in the county in the C11th and C12th. Flint walls and structures survive at Berkhamsted and Hertford. From the C15th ecclesiastical manors and larger houses were often built of Quaternary Flint with brick or stone dressings.

Notable examples of the use of Quaternary Flint (often in association with Quarry Flint) can be seen in the curtain wall to Hertford Castle Bailey, Hertford, the Roman City Wall, Clock Tower, St Michael's, St Albans, St Mary's, Reed and St Mary's, Ashwell. It was also used at Our Lady Help of Christians Roman Catholic church in Rickmansworth (1909) to face a largely concrete structure.

**Glacial pebbles and cobbles**

Accumulations of Quaternary-aged fluvioglacial deposits in Hertfordshire are usually thin (rarely exceeding 5m in thickness) and encompass a diverse range of poorly sorted, relatively soft and unconsolidated sediments. These vary in composition, but sometimes contain harder pebbles and cobbles of Flint, chert, chalk, brown or purplish Permo-Triassic quartzitic sandstones, Carboniferous limestones and sandstones, Jurassic limestones, Lower Cretaceous Greensand and ironstones (Carstone) and occasional igneous and volcanic rocks including basalt, rhyolite and tuff.

These deposits were formerly widely exploited for construction materials mainly on a local farm or village scale. The harder pebbles and cobbles yielded as a by-product of this activity served as a convenient source stone for local buildings. Most are cobbles of brown and purplish quartzite, which were likely derived from the Triassic Chester Formation of the west and east Midlands.

The presence of these pebbles and cobbles in buildings in Hertfordshire is sporadic. Seventeen churches in the county are constructed of Flint (mainly Quaternary Flint) with Glacial pebbles and cobbles. Examples can be seen in churches in the north of the county at the Church of St Mary, Hitchin (C12th-
C15th), St Mary’s, Ashwell (C14th) and St Nicholas, Hinxworth (C14th). A few churches are predominantly built of such material, such as St Mary the Virgin, Great Wymondley (C13th-C15th) and St Peter, Holwell (rebuilt 1877-79).

**Tufa (Travertine)**

Tufa is a whitish or pale grey coloured limestone formed by the precipitation of calcium carbonate (lime) in or adjacent to springs issuing from calcareous rocks (such as chalk or limestone). It is often highly porous and open-textured, with up to 50% void space. Blocks may be ‘fibrous’ and contain the impressions of vegetation, and sometimes exhibit faint traces of banding. When freshly-quarried, Tufa is soft and crumbly and is easily cut into blocks suitable for use as ashlar, but upon exposure to air it hardens to become a useful, more general building stone.

Tufa is very localised in its occurrence in Hertfordshire. It is reported from the Upper Lea valley near Coldharbour Farm. Other Holocene-aged exposures are likely to occur in other Hertfordshire river valleys. Deposits are also reported from the Hinton, Hitchin, Letchworth and Stevenage areas – the last three are near to St Ippolyts. Tufa has a very localised and sporadic use as a rubblestone in mediaeval church walls: St. Ippolyts at St. Ippolyts, Great St Mary’s at Sawbridgeworth, St. Mary’s at Cheshunt, St. Mary’s at Gilstone and in St. Albans Abbey. Some of these reports may include reuse from earlier, probably Roman, sites.

The C14th Church of St. Nicholas, Hinxworth is constructed of various stone types including Chalk, Quarry Flint, Quaternary Flint and a range of Glacial pebbles and cobbles that are particularly impressive on the north and south walls of the nave and main entrance porch.

The Church of St Ippolyts, St. Ippolyts (also spelt Ippollitts) has Norman origins. The walls contain a wide range of building stones including Tufa, Quaternary Flint and Hitchin Carstone along with occasional Glacial pebbles and cobbles, and isolated blocks of Hertfordshire Puddingstone and False Puddingstone (see also Page 15).
Overall, Hertfordshire has few locally-sourced building stones and there are no quarries currently extracting building stone in the county. This limited availability of indigenous building stone has resulted in the extensive use of imported stones. These have been sourced from various parts of England and also from further afield.

Stone has been imported into Hertfordshire since at least the Roman period. From Anglo-Saxon times until the C17th, stone for the dressings of churches and larger houses was frequently imported from nearby sources in Bedfordshire (e.g. Totternhoe Stone) and Buckinghamshire (Upper Jurassic limestone). Barnack Stone from Cambridgeshire was quite extensively used from the Roman period on, particularly in pre-Reformation churches for dressings. It was used in Roman Verulamium and subsequently re-used in St. Albans Abbey. The stone was also used for the quoins of St. Mary’s Church at Northchurch for example. It features in the churches at Reed, Walkern and Westmill. It can also be seen, together with Flint rubble and clunch, within the fabric of St. Leonard’s Church in Bengeo.

The scale of importation increased dramatically from the C18th with improved transportation. A wide range of stones was used for the ornamental dressings of mansions, civic buildings, churches and chapels and for street paving and kerbing. From the C18th, Portland Stone from the Isle of Portland in Dorset began to be used. For example, the chancel of The Church of St. Mary Magdalen, Offley was completely rebuilt using Portland Stone in 1777. The Church of New St Lawrence, Ayot St Lawrence (1778) and the façade of Haileybury College (1807) were constructed of the same stone. Granite from south west England and diorite from Leicestershire were used for paving in St. Albans, for example.

The rapid population growth of the C19th led to the construction of a comparatively large number of new civic buildings and both Anglican and Roman Catholic churches. Imported stone, including Bath Stone, was extensively used for decorative effect in churches of the Victorian High Gothic, often in conjunction with brick and Flint. Middle Jurassic ooidal limestone was used for the churches of the three new parishes created in the county during the C19th – namely Boxmoor (1874), Lemsford (1859) and Langleybury (1864).

Imported stones were also often used for C19th restorations of pre-Reformation churches to replace decayed and damaged Totternhoe Stone and Chalk. Middle Jurassic ooidal and bioclastic limestones such as Ancaster Stone and Barnack Stone were often (and continue to be) employed. Kentish Rag was also used in no fewer than 14 churches during the C19th including those in Bengeo, Bishop’s Stortford, Bushey Heath, Hatfield Hyde, High Cross, Hockerill, Little Berkhamsted, Perry Green, Thundridge and Ware.

Very occasionally an entire church was constructed of imported stone. For example, the Church of All Saints, Hertford (rebuilt 1893-95) was designed by architects from Lancaster (Paley, Austin and Paley), who chose to use Triassic Runcorn Stone from Cheshire.

A summary of the main imported building stone types which have seen use in Hertfordshire follows below. Additional descriptions of imported stones relevant to Hertfordshire can be found in several of the references listed in the Further Reading section of this Atlas and in the Strategic Stone Study atlases covering the source areas of these various stones.
**Carboniferous Limestone**  
*Derbyshire*

**Lower Carboniferous**  
Peak Limestone Group (likely the Bee Low or Monsal Dale Limestone formations)

A pale to dark grey coloured bioclastic limestone, distinctly packed with fossil shells and ring-shaped crinoid ossicles (up to 2cm across) and crinoid stems (up to 5cm long). These fossils are typically white or pale cream in colour and contrast strongly with the grey limestone matrix especially on polished surfaces.

*Polished Carboniferous Limestone pillars in the entrance porch of the West Front of St Albans Cathedral. This part of the Cathedral was constructed during the C19th*

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**Millstone Grit Sandstone**  
*Derbyshire*

**Upper Carboniferous**  
Millstone Grit Group

Hard, medium- to coarse-grained sandstone, sometimes pebbly and feldspathic, with a distinctive granular appearance (arising from sugar-like, grey quartz grains) and occasional small flakes of white mica. It exists in various colours, ranging from pale grey and pink (on fresh surfaces) to a buff or pale brown colour (particularly when weathered). Employed sporadically in Hertfordshire and is usually associated with industrial or transport infrastructure such as bridges and walling along canals and railways.

*Dixons Wharf, near Wilstone on an arm of the Grand Union Canal was constructed in 1888 from blocks of Millstone Grit Sandstone.*

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**Carboniferous Sandstone**  
*Bradford, West Yorkshire*

**Upper Carboniferous**  
Possibly Pennine Coal Measures Group

A fine- to medium-grained, flaggy to massive, yellow-orange sandstone which is commonly micaceous. It is relatively soft and weathers with a distinct exfoliation pattern.

*Blocks of yellow-orange weathered Carboniferous Sandstone in the Clock Tower in St Albans (along with locally sourced Flint) which was constructed in 1403-1412*
Mansfield Red Stone
*Mansfield, Nottinghamshire*
Permain
Cadeby Formation, Zechstein Group

A distinctive uniform, red-brown sandy dolostone / dolomitic sandstone employed very occasionally in Hertfordshire as a facing and decorative stone. One of the best examples of its use is provided by the front of the National Westminster Bank in St. Albans.

*The National Westminster Bank in St Peter’s Street, At Albans built in the late C19th or early C20th in a Neo-Gothic style uses Mansfield Stone on the ground storey, entrance doorways and dressings*

York Stone (general sense)
*West / South Yorkshire*
Upper Carboniferous
Pennine Coal Measures Group

Buff to pale grey or greenish grey, typically fine-grained sandstones, which are often micaceous and laminated, but occasionally show small-scale cross-bedded structures. Usually weathers evenly but may separate along mica-rich horizons. Little used as a building stone in Hertfordshire, being employed mainly as flagstones, paving stones or as plinths.

*York Stone paving slabs outside the main nave and north transept of St. Albans Cathedral*

Runcorn Red Sandstone
*Cheshire*
Triassic
Sherwood Sandstone Group

A pale red, pink or red-brown and buff coloured sandstone that often exhibits attractive bands of small-scale cross-beds, laminations and ripple marks seen in many blocks used in buildings. It is only occasionally employed in Hertfordshire and mainly for decorative purposes, especially as corner stones, quoins or window dressings but is occasionally also used as ashlar.

*Entrance door at the West Tower of the attractive All Saints Church in Queen’s Road, Hertford, built in 1893-95 of Runcorn Red Sandstone ashlar*
**Doulting Stone**  
*Doulting, Somerset*  
*Middle Jurassic*  
*Inferior Oolite Group*  
A cream-coloured, cross-bedded fossiliferous limestone with a uniform, coarse ‘sugary’ texture created by abundant crinoid debris set in a matrix of calcite. Rarely used in Hertfordshire and mainly as dressings.

*All Saints Church, Borehamwood* was built in 1909 in Jacobean style. It is constructed of red brick with dressings of Doulting Stone.

**Ham Hill Stone**  
*Montacute, Somerset*  
*Lower Jurassic*  
*Bridport Sand Formation (‘Ham Hill Limestone Member’), Lias Group*  
A medium- to coarse-grained shelly limestone which is readily sawn and dressed. When freshly cut the stone has a light golden yellowish-brown colour but this darkens with age and weathering. The latter picks out the weaker, less well cemented seams and cross-bedding features which are characteristic of this sandy limestone. Relatively little used in Hertfordshire, and where it has been recorded the stone is usually employed in only small amounts for decorative work and is seen to be relatively devoid of cross-bedded features.

*The C19th West Porch of St. Albans Cathedral is recorded to be partly constructed of Ham Stone, although some of the stone employed in the interior pillars and archway is more reminiscent of Bath Stone.*

**Permo-Triassic Sandstone**  
*Possibly from Midlands*  
*Permian-Triassic*  
*Various Formations/Groups*  
Red-brown, fine-grained dolomitic-quartz sandstones. The individual sandstone types and source of these ‘New Red Sandstones’ is often impossible to determine in the absence of documentary or petrological evidence. These sandstones are employed only occasionally in Hertfordshire but do feature in ashlar work and decorative bands of certain buildings. One of the best examples of their use are seen in Lululaund where the stones is employed alongside **Bavarian Tufa** which was probably sourced from either Andelsbuch in the Vorarlberg area of the westernmost Austria Alps (Andelsbuch Tufa) or the Brannenburg area of Bavaria (Thiersee Tufa).

*The remaining part of the west front of Lululaund, Bushey, built in a Romanesque revival style with Permo-Triassic red sandstone and pale grey Bav!arian Tufa.*

**Bavarian Tufa**  
*Possibly from Austria*  
A tufa derived from a travertine deposit which is light grey-brown in color. Typically used for small decorative elements.

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Barnack Stone
*Barnack, Cambridgeshire*
Middle Jurassic
Lincolnshire Limestone Formation, Inferior Oolite Group

Barnack Stone is a typically hard, pale buff coloured, coarse-grained, shelly oolitic limestone cemented with sparry calcite. The stone usually displays cross-bedding and differential weathering of its constituent grains (ooliths of varying sizes and fossil shell debris up to 5mm in size) imparts a 'rough feel' to exposed surfaces. In Hertfordshire, Barnack Stone, along with other imported Inferior Oolite limestones from the Lincolnshire Limestone Formation (including Ketton Stone and types described below) tend to have been used in the construction of prestigious buildings, especially for the dressings of churches or chapels.

*The Church of St. Mary, Reed dates from the early C11th and is constructed mainly of local Quarry Flint with some Quaternary Flint nodules, Chalk clunch and Barnack Stone dressings*

Clipsham Stone
*Clipsham, Rutland / Lincolnshire*
Middle Jurassic
Lincolnshire Limestone Formation, Inferior Oolite Group

Clipsham Stone is a rather poorly sorted, medium- to coarse-grained, peloidal and bioclastic limestone. It is usually pale cream or greyish buff in colour but features sporadic blue patches. 'Blue-hearted' blocks weather over time to the more typical greyish buff colour. Rarely encountered in Hertfordshire and its use appears to be restricted to the dressings of churches and other ecclesiastical buildings.

*The parapet along the North Transept and Nave of St Albans Cathedral is built of Clipsham Stone*

Ancaster Stone
*Ancaster, Lincolnshire*
Middle Jurassic
Lincolnshire Limestone Formation, Inferior Oolite Group

A medium- to coarse-grained, creamy-white to pale yellow coloured (although rather ochreous in places) ooidal and bioclastic limestone, the weathered surfaces of which commonly display a 'streaky bacon-like' patterning. In Hertfordshire, Ancaster Stone, along with other imported Inferior Oolite limestones from the Lincolnshire Limestone Formation (including Ketton Stone and types described below) tend to have been used in the construction of prestigious buildings, especially for the dressings of churches or chapels.

*The impressive C19th West Front of St. Albans Cathedral is constructed mainly of Ancaster Stone ashlar*
Caen Stone
Normandy, France
Middle Jurassic
Calcaire de Caen Formation

A white to pale creamy-yellow coloured limestone with a fine-grained texture and few large fossils. It may exhibit spalling and certain blocks of Caen Stone may also show uneven weathering. It has been employed only very occasionally in Hertfordshire and then mainly for decorative purposes.

The Eleanor Cross in the High Street, Cheshunt built in 1291 is one of only three remaining crosses erected by Edward I to commemorate the stopping places of the cortege containing his dead queen Eleanor of Castile. It was originally constructed of Caen Stone but has been part rebuilt and restored in Bath Stone.

Portland Stone
Isle of Portland, Dorset
Upper Jurassic
Portland Stone Formation, Portland Group

A near-white or very pale coloured limestone that (in its ‘Basebed’ guise at least) is typically a fine- and even-grained freestone. It has seen widespread use across Hertfordshire especially in urban areas in carved form and has been used for milestones, obelisks, monuments, war memorials, gravestones, fountains and columns. Portland Stone is also employed as a high-quality walling stone and ashlar, often forming the fronts of civic buildings, banks and schools (e.g. Haileybury College, Great Amwell).

The Almshouses (of Seth Ward’s Hospital) in Buntingford. They date from 1684 and were constructed in plum coloured brick with Portland Stone dressings.
Igneous stone types

**Dartmoor Granite**  
*Dartmoor, Devon*  
*Lower Permian*  
Dartmoor Intrusion - Granite

A pale-coloured, coarse-grained igneous rock comprising an interlocking network of grey coloured quartz crystals with (often larger) white coloured feldspar crystals and small amounts of darker ferromagnesian minerals. Small flakes of pale or dark coloured mica are also present. The large white feldspar crystals (phenocrysts) sometimes possess a regular tabular form and can be aligned in a roughly similar direction within the rock. Dartmoor Granite is a very hard-wearing, durable stone which is usually employed in Hertfordshire for paving setts, kerbing etc.

*Regular paving setts of Dartmoor Granite form the hard-wearing surface of Sumpter Yard adjoining St. Albans Cathedral*

**Bedfordshire Greensand**  
*Bedfordshire*  
*Lower Cretaceous*  
Woburn Sands Formation, Lower Greensand Group

Bedfordshire Greensand comprises greenish-grey to deep orange-brown fine- to medium-grained ironstones and ferruginous sandstones, some of which contain glauconite. Fossils are scarce and mainly represented by non-marine bivalves and gastropods. The stone has not been employed to any great extent for building purposes in Hertfordshire. Its main use is in pre-Reformation churches as rubble walling as at the Church of the Holy Trinity, Weston, or as hewn ashlar blocks such as at St Mary’s, Pirton.

*The Church of St. Mary, Pirton dates from the early C12th but was much rebuilt in the 1870s and 1880s. It is constructed mainly of local Flint (often courséd) with lesser amounts of Chalk clunch and various limestone and sandstone rubble including blocks of Bedfordshire Greensand*

**Kentish Ragstone**  
*Weald of Kent*  
*Lower Cretaceous*  
Hythe Formation, Lower Greensand Group

The name Kentish Ragstone has been applied to a range of medium- to coarse-grained, pale greenish-grey or pale brown limestones, which contain greater of lesser amounts of quartz, glauconite and shell debris. Kentish Ragstone was employed only occasionally in Hertfordshire, for example in 14 churches and a few ecclesiastical buildings.

*The Church of St Peter, Bushey was built in 1836-38 mainly of rock-faced Kentish Ragstone with Middle Jurassic limestone quoins and dressings*
Roofing slates

Several different types of roofing slates are known to have been imported into and variously used in Buckinghamshire since at least the C19th. Welsh Slate for example, was commonly employed in many of the county’s villages and towns (e.g. Aylesbury). Other named types of roofing slates used in Hertfordshire include Cumberland Green Slate and Westmorland Slate.

The Orchard, Shire Lane, Chorleywood was designed by C F A Voysey for himself and built in 1899-1900 in the Arts and Crafts style. It is constructed mainly of roughcast brick with limestone (probably Bath Stone) dressings and a Cumberland Green Slate roof (a typical trademark of Voysey).

The Old School in Church Street, Wheathampstead was built in 1869 in a polychromatic decorated Gothic style. It is constructed of knapped Flint with zig-zag bands of yellow Gault brick under a Westmorland Slate roof incorporating zig-zag patterns in Welsh Slate.
**Glossary**

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

**Bioturbated:** Sediments that have been reworked or disturbed by burrowing organisms such as worms.

**Bivalve:** A mollusc with two shells, which may be marine or freshwater. Examples are cockles, clams, scallops, oysters.

**Breccio-conglomerate:** A type of Conglomerate that contains a mixture of angular and rounded rock fragments or clasts.

**Calcareous:** A sedimentary rock containing a significant amount (10–50 %) of calcium carbonate.

**Chalk:** A soft, white limestone, sometimes powdery, which was formed at the bottom of a sea during Late Cretaceous times.

**Chert:** An opaque, extremely fine-grained sedimentary rock composed of silica (quartz). It occurs as nodules (Flint), concretionary masses, or occasionally as layered deposits.

**Conchoidal fracture:** A smooth fracture surface, often occurring in a fine-grained rock such as Flint, which shows a curved pattern of fine concentric rings or ripples.

**Conglomerate:** A sedimentary rock that comprises broken up, rounded rock fragments, pebbles (>2 mm), cobbles or boulders set in a finer-grained matrix.

**Cretaceous:** A period of geological time that lasted from approximately 145 million to 65 million years ago. Sedimentary rocks of this age are the source of a number of important types of building stone such as Greensand, Flint and Chalk.

**Crinoid:** A fossil ‘sea-lily’ related to modern day starfish and sea urchins. Its stem is composed of circular discs (ossicles) which are frequently found as isolated fossils, especially in limestones.

**Cross-bedding:** A structure in the layers (beds) of a sedimentary rock formed by the movement of water or air. The term is usually applied to sandstones and the feature itself typically resembles sets of lines which are inclined with respect to the bedding planes or form regular arc-shaped patterns.

**Dolostone:** A sedimentary carbonate rock (often a limestone) that contains a high percentage of dolomite (a calcium and magnesium carbonate mineral).

**Echinoid:** A type of marine organism formed of calcareous plates, commonly called a sea urchin. Often found in Chalk sediments.

**Exfoliation:** A type of weathering pattern, often seen in relatively sedimentary rocks, in which the surface layers of rock are weathered and split away as thin layers.

**Feldspar:** A mineral similar to quartz but slightly softer and often coloured white or pale pink depending on its chemical constituents. Occurs in both sedimentary rocks (e.g. sandstones) and igneous rocks (e.g. granites).

**Flint:** A form of very hard, micro-crystalline quartz. Typically occurs in Chalk deposits as rounded or irregular shaped masses (nodules) and has a dark grey or black coloured inner ‘core’, with a white outer ‘skin’.

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

**Glauconite:** A mineral composed of iron and silica. It often occurs in Cretaceous and Tertiary sedimentary rocks as small greenish coloured specks or grains. It gives the green colour to the rock type Greensand.

**Ironstone:** A hard sedimentary rock cemented by iron oxide minerals. Often dark brownish or rusty coloured.

**Knapped Flint:** Worked Flint which has been fractured (cleaved) to reveal the interior of the nodule.

**Lamination:** A small scale sequence of fine layers that occur in sedimentary rocks.

**Liesegang banding:** A type of banded structure which is characteristic of ironstones and iron-rich rock. In individual stone blocks it is often seen as different colour patterns, typically shades of red, orange, brown or purple.

**Massive:** Describes a sedimentary rock which is homogeneous and lacks any internal structures (such as cross-bedding or ripple-marks) or fractures.

**Neoproterozoic:** A period of geological time that lasted from approximately 1,000 to 541 million years ago.
Nodule: A small, hard, rounded or elliptical mass within a sedimentary rock. Resembles a pebble or larger cobble.

Oolitic (Ooidal): A type of limestone that contains ooliths or ooids which are sand-sized (<2mm) rounded grains of mineral or fossil material coated in successive concentric layers of calcium carbonate (limestone).

Peloidal: A type of limestone that contains peloids which are similar to ooids (see oolitic limestone) but typically are formed of very fine-grained mud which lack any discernible internal structure or concentric layering.

Quartzite: A durable metamorphic rock consisting mainly of quartz grains and silica cement, formed by the alteration of a sandstone by heat and pressure.

Quaternary: A period of geological time that lasted from approximately 2.6 million years ago to the present Day. It includes the last Ice Age.

Quoin: 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).

Rhyolite: A fine-grained, acidic volcanic rock, chemically equivalent to granite.

Sarsen Stone: A very hard sandstone formed mainly of silica-cemented quartz grains. Often found as boulders or rounded pebbles.

Stratigraphy: A branch of geoscience dealing with stratified rocks (generally of sedimentary origin) and their organisation into distinctive, generally mappable units.

Superficial deposits: Surface deposits and sediments of various types formed during the Quaternary period.

Syncline: A downward, U-shaped fold or trough in the layers of rock in the earth’s surface.

Tuff: A fragmental volcanic rock dominated by ash-grade debris.
Acknowledgements and References

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This report incorporates data from several sources, including local geologists (Hertfordshire Geological Society, East Herts Geology Club), heritage building specialists, BGS memoirs and references (listed below) along with independent fieldwork by the authors and BGS. Use has also been made of the BGS on-line lexicon of named rock units (www.bgs.ac.uk/lexicon).

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BGS Memoirs, Sheet Explanations and Mineral Resource Reports


Further Reading


Lovell, B. & Tubb, J. (2006). Ancient quarrying of Rare in-situ Palaeogene Hertfordshire Puddingstone. Mercian Geologist 16 (3), 185-189. [This paper was updated by Jane Tubb in 2009 reporting that the puddingstone at Colliers End was not recovered from the base of the Upnor Formation as originally thought, but is more likely from the overlying Reading Formation]


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**Websites**


Hertfordshire Geological Society (accessed 12 June 2018) Reports and Publications, including several leaflets describing town trails, building stones, their locations and uses which are downloadable from the website in pdf format.
http://www.hertsgeolsoc.ology.org.uk/index.htm

East Herts Geology Club (accessed 12 June 2018) Reports including an informative section on Hertfordshire Puddingstone.
http://ehgc.org.uk