The Building Stones of Oxfordshire Villages

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SUMMARY

This article reports the results of a survey of the use of stone in domestic buildings in some 140 villages across Oxfordshire (including former north Berkshire). The survey was part of a national English Heritage project and focused on older buildings, mainly of seventeenth- to nineteenth-century date. A dozen key local building stones have been identified and described, and their distribution mapped. Stone buildings characterize villages in most of the county, except in parts of the Vale of the White Horse and Chilterns, where half-timbered styles with mainly brick infill are the norm. The mapped distribution of different stone types in relation to the surface geology shows that builders made use of the nearest available outcropping stone, even if its quality was poor. Stone roofing tiles are generally limited to the western and central parts of the county.

Oxfordshire is justly known for the charm and diversity of its many stone-built villages. Their appearance varies across the county in relation to the stone used in their construction, from the orange Lower Jurassic Marlstone in the north to the white chalk and dark flint in the south (Fig. 1a–k, below). The different building materials vary not only in colour but also in their properties, such as fissility, strength and porosity. Some building stones split easily along their bedding surfaces or along existing joints, to form rectangular slabs, blocks or tiles, whilst others have an irregular fracture and are not readily shaped. Some lithologies have enough strength and cohesion to be cut and prepared into large blocks for lintels, quoins or plinths, but others can only be used as relatively small pieces of rubble walling stone. Porous building stones need overhanging eaves to protect them from the elements, whilst indurated, impermeable lithologies can resist weathering for centuries. Because the geological properties have determined the way in which different types of stone could be used, they have thereby influenced the masonry styles and overall character of buildings and villages across the county.

In his book *Oxford Stone*, Arkell described the principal stones used in Oxford buildings.[1] At the time, many of these stones were still being quarried locally, and he provided valuable descriptions of both the quarries and quarrying methods. From college records, Arkell was able to compile a historical description of stone usage. This account did not, however, emphasise buildings outside the city, or the poorer-quality building stones often employed in villages. In a later study, Wood-Jones mapped out building stone usage in villages of the Banbury area of north Oxfordshire, and related their distribution to the mapped geology.[2] More recently, Allen surveyed and mapped the stone used in 234 churches and chapels in historic Berkshire built during the late eighteenth to early twentieth centuries.[3] He demonstrated the influence of outcrop and transport routes as well as changing fashion on the choice of stone. His study area included the substantial part of south Oxfordshire which lay within Berkshire until 1974, but there has hitherto been no comprehensive survey of domestic buildings across the modern county. A new impetus was provided by the Strategic Stone Study, a national initiative by English

[1] W.J. Arkell, *Oxford Stone* (1947).
[2] R.P. Wood-Jones, *Traditional Domestic Architecture of the Banbury Region* (1963).
[3] J.R.L. Allen, *Late Churches and Chapels in Berkshire: A Geological Perspective from the Late Eighteenth Century to the First World War*, BAR BS, 432 (2007).

Heritage (EH). In partnership with the British Geological Survey (BGS) and local geologists, EH attempted to identify the sources of important building stones, with a view to protecting such locations in future. Local geoconservation groups helped determine the most significant stones by mapping out and describing their use in buildings and villages across each county. In Oxfordshire, volunteers from the Oxfordshire Geology Trust contributed to this project, and their collected data are summarized in GIS format on the BGS website.[4]

The Oxfordshire survey examined representative domestic buildings in villages across the county. This account describes the principal indigenous building stones in rural houses, and maps their distribution in relation to the local geology. Oxford and the larger towns are not included in the mapping, since the variety of stones employed in them preclude meaningful mapping of their distribution. Neither have we attempted to put the use of specific building stones into a more historical perspective, a dimension which was not included in the Strategic Stone Study. The potential of the historical approach has been demonstrated in the studies by Arkell and Allen, and in an analysis of Burford buildings by the VCH.[5]

A summary of the Oxfordshire contribution to the Strategic Stone Study may be found in the 'Building Stone Atlas of Oxfordshire', which can be downloaded from the BGS website.[6]

SURVEY METHOD

Stone taken from different parts of the same quarry varies in its physical and chemical properties and general appearance. This makes it difficult to establish a definitive description of a particular building stone type, which may have been quarried at several locations. At first we attempted to recognize and map out some fifteen building stones common to Oxfordshire, but eventually reduced this to twelve types whose usage could be demonstrated in a number of villages. We considered a stone type to be a lithologically distinctive stone from within a single stratigraphic formation, but not necessarily from a single quarry source. In many individual buildings, weathering and overgrowths of lichen obscure the character of the stone and leave identification difficult. But because the majority of villages tend to use a single stone type, it was easier to recognize the predominant building stone in a village as a whole, rather than in single buildings. Each of the volunteers involved in the exercise followed specific stone types from one village to the next in order to map their distribution. The focus was on recording the main stones used in the walls of a building, since the stone used for quoins and dressings was often from a more distant source (typically a Jurassic oolitic freestone). The presence of stone roofing slate or thatch roofing was also noted. Some 140 villages in the county were visited, enough to adequately map the distribution of the main building stone types, although coverage was not necessarily uniform. A village was defined as a settlement with a church, thus roughly corresponding to a parish. There are presently 234 parish councils in Oxfordshire. Some small towns were included if they were of a consistent stone type.

Depending on the extent of stone usage, each village was given one of the following subjective ratings:

a) the character of the village is defined by and dependent on the use of stone
b) stone significantly contributes to the character of the village, or
c) the occasional use of stone adds character to the village.

This assessment was based on the buildings in the historic core of the village, generally representing the period from the seventeenth to late nineteenth centuries, before brick came into widespread use. About 120 of the surveyed villages came into one of the categories above.

[4] http://mapapps.bgs.ac.uk/buildingStone/BuildingStone.html.

[5] Arkell, *Oxford Stone*; Allen, *Late Churches and Chapels*, pp. 106–9; A. Catchpole et al., *Burford: Buildings and People in a Cotswold Town* (2008) pp. 121–47.

[6] http://www.bgs.ac.uk/mineralsuk/buildingStones/StrategicStoneStudy/EH_atlases.html.

Some villages had very few domestic buildings built of stone, particularly in the south of the county where the locally available rocks are less suitable.

BUILDING STONE TYPES

Excellent accounts of the geology of Oxfordshire can be found in books by Arkell and Powell,[7] and in memoirs, maps and publications of the British Geological Survey. The outcropping rocks are up to 200 million years old, the oldest the Lower Jurassic in the north, the youngest the Upper Cretaceous in the south, with some scattered later deposits across the county. The rocks are sedimentary in origin, mainly comprising layers of limestone, sandstone and clay. Examples of the main lithologies are on display in the Oxford University Museum of Natural History.

We here describe the twelve most significant building stone types, starting with the oldest, and briefly mention three of very restricted occurrence. Table 1 lists, in geological sequence, the thirteen mappable stratigraphic units containing these stone types.

Table 1. Oxfordshire building stone types and corresponding stratigraphic units

Building Stone Type	Rock Stratigraphic Unit	Time Period
River gravels (Old Rag)	Upper Thames Valley Formation	Quaternary
Sarsen stone	Lambeth Group	Paleocene
Flint	White Chalk Subgroup	Upper Cretaceous
Chalk Stone, Chalk Clunch	Grey Chalk Subgroup (Melbourn Rock Member)	Upper Cretaceous
Sponge gravel	Lower Greensand Group (Faringdon Sponge Gravel Formation)	Lower Cretaceous
Upper Portland	Portland Group	Upper Jurassic
Corallian, including Wheatley Limestone, Headington Hardstone, Headington Freestone, and Coral Rag	Corallian Group (Stanford Formation)	Upper Jurassic
Cornbrash	Great Oolite Group (Cornbrash Formation)	Middle Jurassic
Forest Marble	Great Oolite Group (Forest Marble Formation)	Middle Jurassic
White Limestone	Great Oolite Group (White Limestone Formation)	Middle Jurassic
Taynton Stone, Stonesfield Slate	Great Oolite Group (Taynton Limestone Formation)	Middle Jurassic
Chipping Norton Limestone	Great Oolite Group (Chipping Norton Limestone Formation)	Middle Jurassic
Marlstone (including Hornton Stone, Banbury Ironstone)	Lias Group (Marlstone Rock Formation)	Lower Jurassic

[7] W.J. Arkell, *The Geology of Oxford* (1947); P. Powell, *The Geology of Oxfordshire* (2005).

1. Marlstone

Marlstone, also known as Hornton Stone or Banbury Ironstone, is an iron-rich limestone quarried from the Middle Lias (Lower Jurassic) of north Oxfordshire. It weathers to a distinctive, golden-orange to brown colour but can appear bluish-green when fresh or unweathered. It contains abundant shelly fossils, typically clusters of brachiopods. Both freestone and a rougher, rubbly stone were quarried, so that Marlstone could be used for both walls and dressings, in both small and large buildings. However, it is susceptible to weathering and spalling, as evident in older buildings where it has been replaced with more durable oolitic limestone. The warm-coloured Marlstone characterizes the cottages in many villages such as Great Tew, Deddington, Adderbury, Bloxham, Wroxton (Fig. 1a), Hook Norton and Hornton, as well as stately homes such as Broughton Castle and Chastleton House.

2. Chipping Norton Limestone

This is a buff to white, medium- to coarse-grained oolitic limestone, from the Great Oolite Group of the Middle Jurassic. It lies stratigraphically lower than the Taynton Stone but is similar in appearance, though is quite variable and sometimes has a flaggy character. Some bands are full of broken shells. Quarried from around Chipping Norton and Charlbury (Fig. 1b), it was used as a durable freestone in the buildings of these towns and other local villages. The flaggier lithology provided roofing tiles, and the Castle Barn quarry at Sarsden still produces stone tiles from this formation.

3. Taynton Stone

This is a buff to white, coarse-grained oolitic limestone from the Great Oolite Group of the Middle Jurassic, typically cross-bedded and with abundant broken-up shell fragments. It weathers to a light- or golden-brown colour, sometimes with a striped appearance due to differential erosion of beds of varied grain-size or hardness. Being strong and durable, it was quarried for many hundreds of years from quarries around Burford. The thicker layers provided a freestone which could be cut and shaped into ashlar blocks or decorative dressings for door and window surrounds. From the Taynton Quarry itself, blocks up 2 metres in height were obtained, but similar stone came from Kit's Quarry in Upton, also from nearby Swinbrook and Milton, and from Barrington, Windrush, and Sherborne across the border in Gloucestershire. It is no longer quarried in Oxfordshire but a comparable stone is produced at Farmington, Gloucestershire.

Both freestone and rubble blocks were extracted. These were used locally, to build the honey coloured stone houses and churches in towns such as Burford (Fig. 1c), and also in many Oxford buildings further afield. The freestone was used in quoins and dressings of buildings across the county, reinforcing walls of more local stone.

4. Stonesfield Slate

The Stonesfield Slate is a flaggy, grey, micaceous and calcareous sandstone, forming concretionary lenses within the Taynton Stone Formation, and found as a thin sheet of very limited extent around the village of Stonesfield.[8] It can be split into thin tiles (known as pendles), which were widely used for the roofs of Cotswold cottages and Oxford colleges. Thin beds of the stone (up to 2 metres thick) were mined from underground seams, accessed from narrow hillside adits and shafts. By exposing the moist, freshly dug slabs above ground to the natural action of winter frosts, they became easy to split. The slates are greyish-cream in colour and not as thin or smooth as the true slates of metamorphic origin from the quarries of Wales and

[8] W.S. McKerrow and S. Baker, 'Field Meeting to Charlbury and Stonesfield, Oxfordshire,' *Proceedings of the Geologists' Association*, 99 (1988), pp. 61–5.

the Lake District. The local slate industry lasted from the late sixteenth to the early twentieth century, but the occurrence has now been totally worked out. The smaller slates were used in the upper parts of a roof, grading into larger and heavier slabs towards the base. The term 'pendle' applies only to the frost-split slates. Stone slates or tiles from other geological formations in the Cotswolds, such as the Forest Marble or Chipping Norton Limestone, were known as 'presents'. These were quarried from surface outcrops and could be split more readily with a pick, but produced smaller, thicker, uneven slabs.

5. White Limestone

This is a creamy or whitish, fine-grained, thinly bedded limestone, from near the top of the Great Oolite Group of the Middle Jurassic. The bio-turbated limestone contains a scattering of ooliths and pellets, and fragments of bivalve and brachiopod shells. It was used as a flaggy, rubbly, walling stone in domestic buildings and churches along the south flank of the Cotswolds, in a belt from Minster Lovell, through Eynsham (Fig. 1d) to Ardley.

6. Forest Marble

The term Forest Marble was first applied by William Smith (1769–1839) to a grey, coarse-grained, cross-bedded oolitic limestone, crowded with blue-black fragments of oyster shells, from the top of the Great Oolite Group. The stone could be polished for decorative use and was used for internal ornamentation as well as external use. It was quarried from the Wychwood Forest area, from around Filkins and from the East End quarry at North Leigh. The best stone came from the Longround and Horse Bottom quarries to the north-west of Filkins, where all of the older cottages were built of Forest Marble. A flaggier facies was used for roofing tiles, steps, stone paving and as upright slabs for fencing (Fig. 1e) notably in the Filkins area.

7. Corallian

The Corallian Group is an Upper Jurassic group of limestones and calcareous sandstones, which outcrop along the Midvale Ridge between Faringdon and Wheatley. It has provided a variety of notable building stones from quarries in Wheatley, Headington and elsewhere, mainly from a limestone unit now known as the Stanford Formation. These building stones have been given names such as Coral Rag, Headington Hardstone, Headington Freestone and Wheatley Limestone (Fig. 1f).

Their variability precludes easy characterisation. Some contain fragments of corals, both branching and massive, the branching examples often replaced by crystalline calcite or weathering out to give tubular cavities. Other stones are poorly bedded, shelly or sandy limestones, but less commonly oolitic or pisolitic. The sandstones contain rounded grains of quartz or dark chert. The colour is whitish-yellow but weathering to a darker grey or dull brown. Typically, Corallian building stone is hard and durable, but the rubbly character means that it is difficult to shape into regular building blocks and it was mainly used for rough-coursed walling stone rather than as dressings or ashlar. It can be seen in the villages of the Midvale Ridge, in the walls of the thirteenth-century Great Barn at Coxwell, and in the older buildings of Oxford.

8. Upper Portland

This is a creamy white, sandy to gritty, bioclastic limestone from the Jurassic Upper Portland Group, locally rich in shell fragments. It was once quarried as a freestone from a thin band in the area of east Oxfordshire around the Miltons and Haseleys. Roughly cut, irregularly sized blocks were used in local cottages and for the walls of Great Milton church. Large ammonites may be seen incorporated in some cottage walls (Fig. 1g).

9. Chalk Stone

A relatively durable, creamy white chalk was obtained from a restricted area of the Grey Chalk Subgroup of south-west Oxfordshire. It was easy to cut, and could be shaped into uniform,

Fig. 1a. Marlstone: cottage, Wroxton.

Fig. 1b. Chipping Norton Limestone: townhouse, Charlbury.

Fig. 1c. Taynton Stone walls and dressings, with stone-tiled roof: Bay Tree Hotel, Burford.

Fig. 1d. White Limestone: Market Hall, Eynsham.

Fig. 1e. Forest Marble: flagstones used as fencing, Kelmscott.

Fig. 1f. Wheatley Limestone (Corallian): cottage, Wheatley.

Fig. 1g. Upper Portland limestone: wall with ammonite, Great Haseley.

Fig. 1h. Chalk Stone: cottage, Ashbury.

Fig. 1i. Chalk Clunch: barn wall, Mackney.

LEFT: *Fig. 1j. Knapped flint: wall, Brightwell-cum-Sotwell.*

ABOVE: *Fig. 1k. Sarsen Stone and Chalk Stone: cottage wall, Ashbury.*

rectangular blocks, up to 50 cm across, for use in regularly coursed walls. Quoins and dressings were normally of a harder limestone or brick, and extra support was provided around windows and doors by wooden beams, brickwork or stone. Because chalk is porous (its porosity can be around thirty percent), it was essential to have 'good shoes and a hat' to prevent the chalk absorbing water and spalling after winter freezing. This required a foundation plinth of brick or sarsen, and an overhanging roof (typically thatch) to keep the chalk dry. Chalk Stone buildings are seen in the south Oxfordshire villages around Ashbury (Fig. 1h), Compton Beauchamp, Uffington and Woolstone. The substantial seventeenth-century hunting lodge of Ashdown House was built of white Chalk Stone with quoins and dressings of stronger limestone. The stone is believed to come from a hard band such as the Melbourn Rock within the Grey Chalk Subgroup.

10. Chalk Clunch

A less durable, creamy grey chalk is seen in buildings along the base of the chalk escarpment from Blewbury through Wallingford, Benson, Warborough, Cuxham and Watlington. This is a friable, flakey chalk, which was not easily shaped into regular blocks. It has low strength and weathers poorly, tending to absorb water and spall after winter frosts (Fig. 1i). It was used as a rubbly walling stone, sometimes interlayered with courses of stronger brick or more resistant flint. A base of less porous material (brick, sarsen or flint) was required, and quoins and dressings of stronger material.

One source of such chalk was the Chalk Pit at Blewbury, which provided a poor quality chalk building stone from the Melbourn Rock of the Grey Chalk Subgroup. Other similar material may have come from the underlying Upper Greensand Formation.

11. Flint

Flint is a very hard, glassy, siliceous material, occurring as irregularly shaped nodules, rarely more than a few tens of centimetres in size, within the upper units of chalk, the White Chalk Subgroup. Newly excavated nodules are black with an outer coating of porous whiter 'cortex', but may become yellow-stained from prolonged exposure to clays or soils. Flint splits along curving 'conchoidal' fractures rather than the regular bedding surfaces or joints of many sedimentary rocks. It is, however, resistant to weathering and can thus be used in walls as a protective outer layer. Flints can be used in their original nodular form, in an uncoursed rubbly wall, or can be split or 'knapped' to expose a black, glassy surface, arranged to face outwards. The shiny knapped surfaces do not bond as well with mortar as the porous cortex, so stone or brick courses were often incorporated in a flint wall to give it extra cohesion.

Local field flints, embedded in abundant mortar, were used to build the rough walls of Anglo-Saxon and Norman churches (for example St Leonard's church in Wallingford) although their small size precluded use as corner stones or as window or door surrounds, for which another material, usually brick or limestone, was generally used. In later centuries the flints were more carefully selected and were often fully knapped into squared blocks, which could be laid either in regular courses (Fig. 1j), or interspersed with limestone blocks to give decorative chequer-work patterns. The seventeenth-century façade of Flint House, Wallingford is a fine example of the latter. Flint was used in the far south of the county for both churches and domestic walling, experiencing a revival in popularity during the Victorian era.

12. Sarsen Stone

Sarsen stones occur as large blocks up to several metres in length, found as isolated boulders resting in valleys of the chalk Marlborough Downs in south Oxfordshire. These are the scattered remnants of an indurated sandstone, equivalent to the friable Palaeocene sands found in the London Basin. Huge sarsen stones were used five thousand years ago in their natural unshaped state, by the Neolithic builders of the Wayland's Smithy long barrow. The stone is a hard, strongly cemented, quartz sandstone, which in these structures has resisted weathering for

thousands of years. However, being so hard, it was not easy to shape. Thus sarsens were initially used in buildings in their original, unhewn condition. Small, unshaped stones are seen in rough-coursed walls around Ashbury (Fig. 1k) and Uffington, with dressings made of brick, or as the foundation plinths of Chalk Stone or Clunch buildings.

In later years, heating methods were used to break up the stone into regularly sized blocks. Working the stone into rectangular blocks became easier in the mid nineteenth century with the introduction of machinery. The church of St James in Sotwell (near Wallingford) was rebuilt in 1884 from such regular sarsen blocks.[9] The few remaining natural occurrences of sarsen stone in the county are protected sites, so for restoration work the only source is stone recycled from demolished buildings.

Other Building Stones

In addition to the lithologies described above, other stones have been used in a very local context, but have not been mapped in this survey.

- The Cornbrash Formation, a yellowish, rubbly, shelly limestone above the Forest Marble at the top of the Great Oolite Group, has been used as a walling stone around Carterton and Broadwell.
- The Sponge Gravel, a dark brown, fossiliferous gravel from the Cretaceous Lower Greensand, was used in the Faringdon area, where blocks can still be seen in the walls of the Great Barn at Coxwell.
- Around Stanton Harcourt, a remarkable development of the Quaternary river gravels occurs, where an iron-rich, deep red cement has bonded the buff-coloured limestone pebbles into a stone. It was known locally as Old Rag, and was hard enough to have been used in the standing stones of the Devil's Quoits circle of monoliths, and as a decorative course in the walls of the church at Stanton Harcourt.[10]

RELATIONSHIP TO GEOLOGICAL OUTCROP

Figure 2 illustrates the distribution of stones used in the walling of Oxfordshire village buildings, superimposed on a map showing the outcrop of the corresponding geological units. Distribution of Stonesfield slate and other stone roof tiles is shown in Fig. 3.

The size of the circles indicates the relative importance of stone usage in each village. In the northern half of the county, stone significantly defines the character of most villages, whereas to the south, where softer rocks outcrop, stone is less evident. In the far south, although flint is widely available, it rarely predominates as a building material, except in church fabrics. In the Vale of the White Horse (underlain by clay), stone is hardly used in domestic buildings. For instance, in the area between Abingdon, Wantage and Didcot the dominant vernacular style of the older buildings is a wood-frame construction, with typically a brick infill.

The survey was of a reconnaissance nature and some stone identifications remain uncertain and subject to correction or more detailed subdivision. However, some general observations can be made. A clear correlation is apparent between the distribution of a building stone and the mapped outcrop of the corresponding geological unit. This suggests that the choice of stone in ordinary domestic buildings was not based on selecting the best quality or most attractive material but was simply making use of what lay close at hand. Local stone was supplemented by judicious use of better quality materials for the critical components such as quoins or lintels, where strength was essential. The use of the excellent quality Taynton Stone seems surprisingly restricted as a vernacular walling stone, perhaps because it could fetch a higher price for use in

[9] Allen, *Late Churches and Chapels in Berkshire*, pp. 78–81.
[10] Arkell, *The Geology of Oxford*, p. 217.

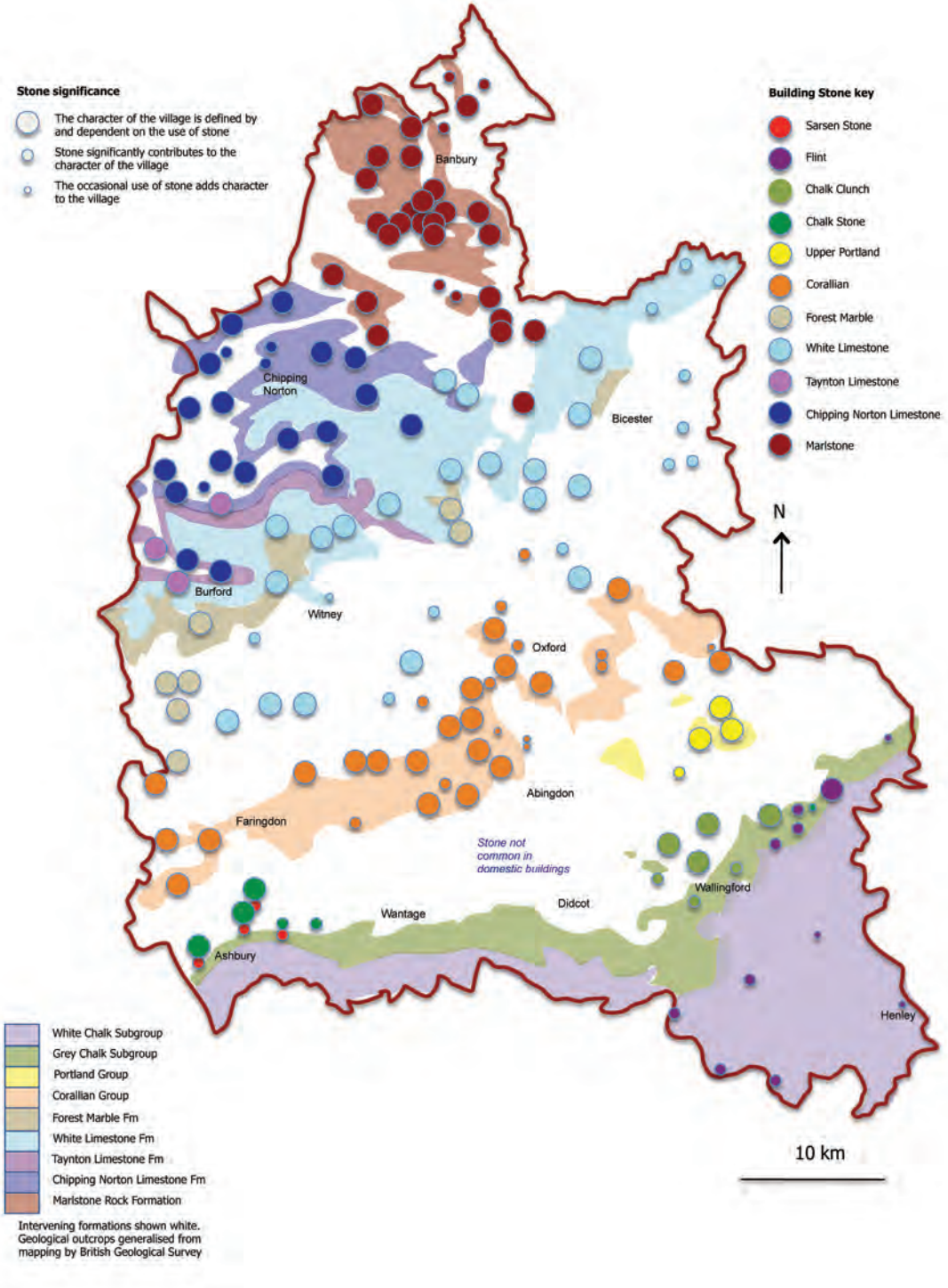

Fig. 2. Distribution of stone types used in the walling of Oxfordshire village buildings, superimposed on a map showing the outcrop of the corresponding geological units.

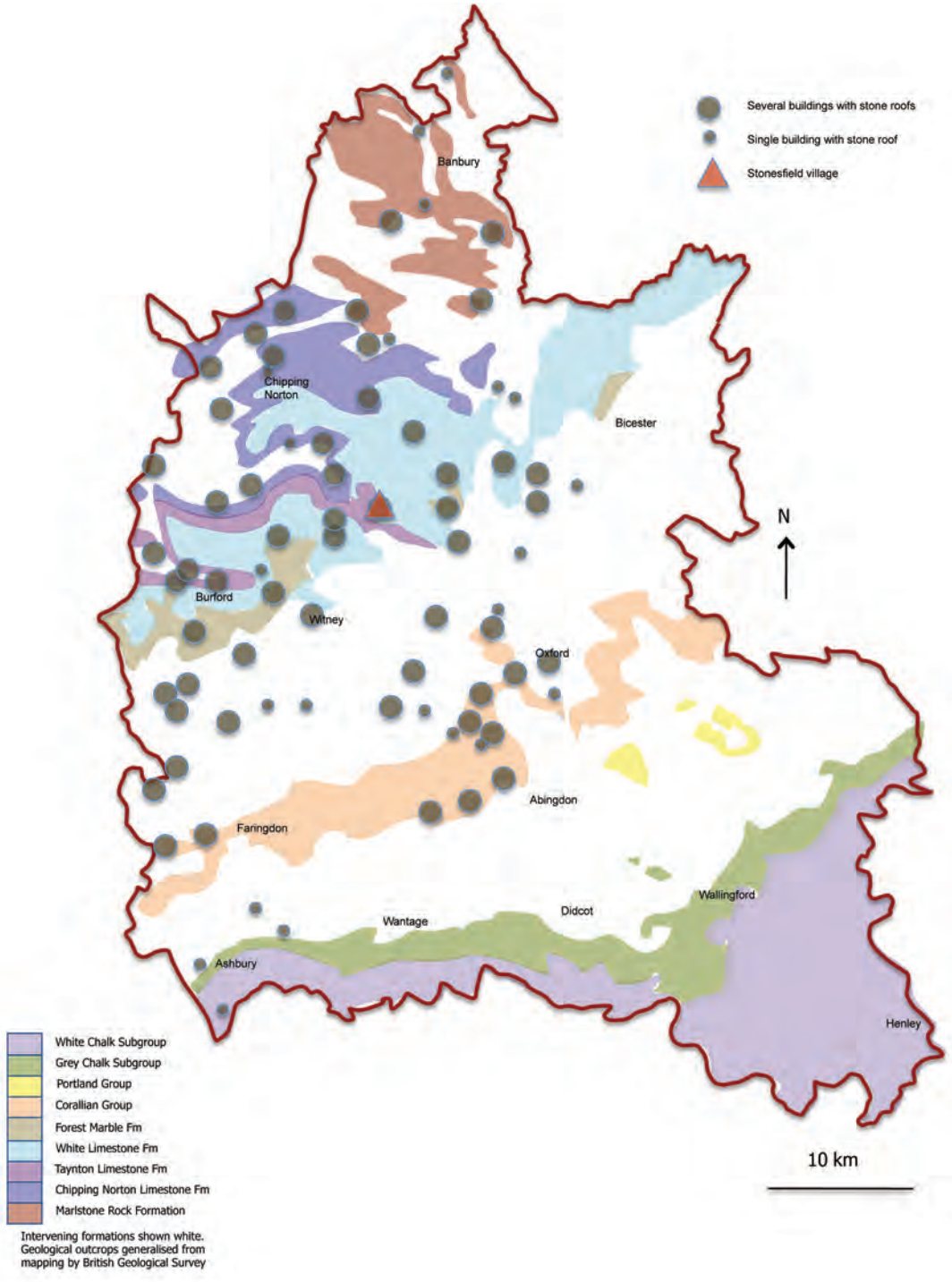

Fig. 3. Distribution of Oxfordshire villages where stone tiles are commonly seen as a roofing material.

the walls of grander churches and college buildings across the county. The less versatile White Limestone, on the other hand, was used over a wide area, including in villages across the clay vale south of its outcrop.

Figure 3 maps the villages where stone tiles are commonly seen as a roofing material. Their source is assumed to be mainly from the Stonesfield Slate lithology, but some may come from the Forest Marble or Chipping Norton Limestone. Stone roofing is not common in the south, east or far north of the county.

DISCUSSION

The correlated distribution of building stones and their related outcrop implies that the cost of transport was a major factor in choosing a building material. Wherever possible, stone used for rural domestic building was obtained from the nearest source, even if this resulted in the use of a lower-quality stone such as Chalk Clunch. Rarely were domestic village buildings constructed of stone from more than 10 km away, and in the absence of such local stone, other materials such as wood and brick predominate. It is suggested that the supplementary use of a stronger, non-local stone, for quoins, lintels or plinths, or as interbanded courses, was more likely to be for practical reinforcement purposes, rather than for decorative reasons. Such stone (or brick) would have added extra transport expense.

The spread of stone roofing tiles includes villages up to 20 km away from Stonesfield village, although this was not necessarily the source of all such tiles. The weight of the thin stone slabs needed to cover the roof of a building would have been much less than that of the blocks of stone needed for its walls, perhaps justifying transport over a greater distance.

The distinctive variety of Oxfordshire village buildings can thus be seen as a function of both the varied geology and a practical need to minimize the cost of transporting materials. The result is a mixture of building styles exploiting the physical properties of each stone lithology, and incidentally giving rise to the attractiveness of the village landscapes seen across our county.

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