

BUILDING STONES OF THE CHILTERNs

A general impression is that the Chilterns only have chalk and flint to offer in the way of the 'rocky resource' required for the many purposes used by people over the centuries, including buildings. The Chilterns have a surprising amount of stone resources, but in addition there has always been a good number of tracks and river routes and, using these routes, resources can shift short distances from adjacent regions .

The Chilterns is a 74 km long strip of hills stretching from Goring in Oxfordshire through Buckinghamshire, Bedfordshire to near Hitchin in Hertfordshire. These counties all offer a different 'flavour' to Chiltern's building materials. In addition to the backbone of Chalk and flint, there are a number of other deposits. Some of these are loose, unconsolidated materials and some are hard stone. Some lie on top of the Chalk hills, and some lie beneath, but they are sufficiently close to the escarpment to have been quarried and brought into Chiltern's buildings.

Landscape is strongly dictated by the rocks lying beneath the surface, but weathering and erosion over many millions of years also plays a part. This final imprint on the rock story – erosion – would also include events such as the cutting down of all our river valleys such as the Thames, Colne, Lea, Ouse and Ouzel, and also by a large number of chalk streams such as the Misbourne, Chess, Wye, Gade and Ver.

Age-wise the rocks within a transportable distance range from 190 million years old (from the Jurassic period and occurring down in the Vale) to about 40 million years (known as the Tertiary period and mostly laying on top of the Chalk). The Chilterns Chalk itself spans an age range of 95 to 65 million years (a time known as the Cretaceous). All of these rocks were laid in turn like layers of a cake. Overlain on this rock layer cake are loose deposits from the Ice Age and modern alluvium from rivers, which can be thought of as the icing on the cake. There are many different 'bits' to this icing and a lot of it has been worn away and nibbled at. This makes it tricky to find and even trickier to interpret, but this is what makes geology fun!

Of course rock and sediments are not the only resource useful to humans. Our ancient ancestors located many Chiltern's resources such as wood, water and organic materials for shelter and for food or clothing, but stone is the one item that remains in the archaeological record, as it is so robust. People from the early Stone Age (Palaeolithic) onwards made use of their local geological resources. Stone tools are mostly made from flint in the Chilterns and the Thames Valley, but tools can be made from whatever resource was to hand. Quartzite and sandstone pebbles obtained from river or glacial deposits have been used and found in the Chilterns, but others so have others traded from considerable distances for special purposes (as the polished axe below).



Flint blades from Cadmore End, in the Chilterns (left) and an axe made of welded volcanic ash from Langdale in the Lake District. Stone resources from far afield as much as 6,000 years ago.



Building materials used in the Chilterns

Building materials are not plentiful in the Chilterns and have not been easy to exploit in our historical and archaeological past. What geological resources exist, they are not always the best quality for building. However, in past times these were often all that were available. It was from the Victorian period onwards as rail and roads allowed the Chilterns to become better connected to other areas that different materials appear in buildings. Common building materials are:

1. **Clays:** which can be used for bricks or for cob or 'Witchert' walls
2. **Building stone:** Jurassic limestone; various horizons of Chalk including Totternhoe Stone; minor sandstone.
3. **Flints:** either whole or knapped
4. **Cobbles or rounded river pebbles:** from river or glacial deposits
5. **Sarsen:** either sandy or puddingstone
6. **Iron-cemented conglomerate**
7. **Sand and gravel,** including **crushed rock aggregate**

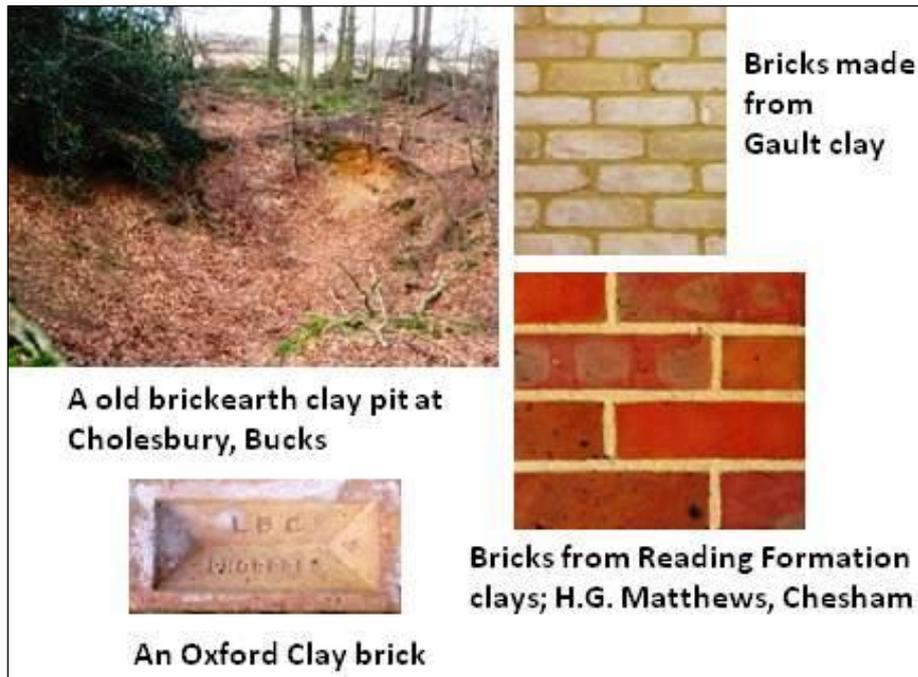
These materials vary greatly across the Chilterns.

Brick clay

There are 3 main types and one minor type of clay used for bricks in the Chilterns:

- **The Oxford Clay** provided top quality and self-firing bricks after the Fletton process was discovered in 1981. This was an important industry from the 1800s onwards and previous centres of production include Newton Longville and Bletchley. Such good quality building materials soon were widespread in the Chilterns. Calvert was the last to close in 1991 with earlier production reaching 8 million bricks per week. There are no quarries open today.
- **The Reading Beds** provided another high quality clay which is only found on top of the Chalk but it has a patchy distribution due to erosion. Hand-made bricks are still being made in the Chesham area by H.G. Matthews Ltd.
- **Clay-with-flints** is a poor quality clay for bricks as it contains impurities including large flints which need to be removed before brick-making can take place. These bricks only ever had a local extraction and distribution.
- **Brick Earths** are found as very small, isolated deposits of clay in the Chilterns, and they formed during the ice age by wind-blown dust collecting into depressions. These and other minor clay sources may have formed tiny and localised production centres in the past.

There are other clays suitable for brick-making such as Gault and Kellaways, but these were never in big production and rarely found their way into the Chilterns. However, the Chilterns is very close to the Gault clay outcrop and these bricks were produced in great quantity at Ardley in Bedfordshire for many years. The pale lemon coloured brick that the grey clay produces is very distinctive.



Building Stone

Stone of a suitable hardness and strength which is also free from flaws is a rare commodity in the Chilterns. However, in the past some of the Jurassic limestones such as the Blisworth (White) Limestone, the Cornbrash, the Portland Limestone and Chalk have all been used. There is also a small area in the Brickhills where a red-brown sandstone is found (Lower Greensand) and occasionally this has found its way into Chiltern's buildings.

Portland Limestone

Largely ignored by the Romans in Bucks, it came into its own during the Medieval period, finding its way into many a Chiltern's church and a mainstay for monuments. Portland Limestone, forming 144 million years ago became an important local source of stone for special buildings. It shows a very characteristic texture of little round balls of carbonate (ooliths) with lots of shells. The fine lines (as



on Ellesborough church in the left image) indicate gentle currents in the tropical sea that formed these particles.

Lower Greensand

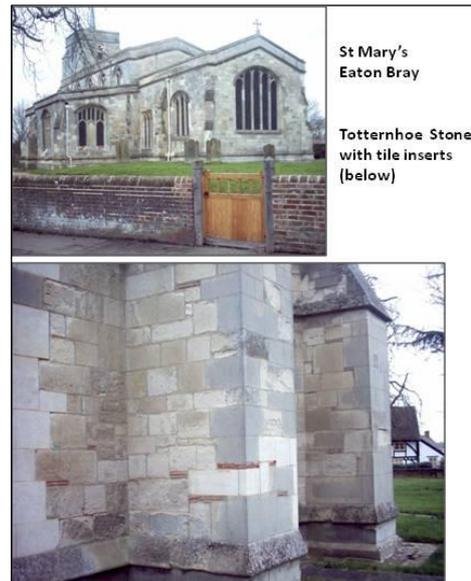
This distinctive red-brown sandstone forms in the vale just beyond the escarpment. It formed 115 million years ago. Look for this rock as stray blocks in Chiltern's churches such as St Nicholas', Barton-le-Clay (see images below).

Chalk

There are several hard beds in the Chalk, but the most used for local buildings are the Totternhoe Stone and the Chalk Rock, and occasionally the Melbourne Rock . All these forms of chalk have been named 'clunch' by the Victorians, and this name often still appears in written accounts.

The order that all the hard beds of the Chalk occur in the geology sequence is:

(top)	Upper Chalk	Top Rock Member
		Chalk Rock
	Middle Chalk	Melbourne rock
(bottom)	Lower Chalk	Totternhoe stone

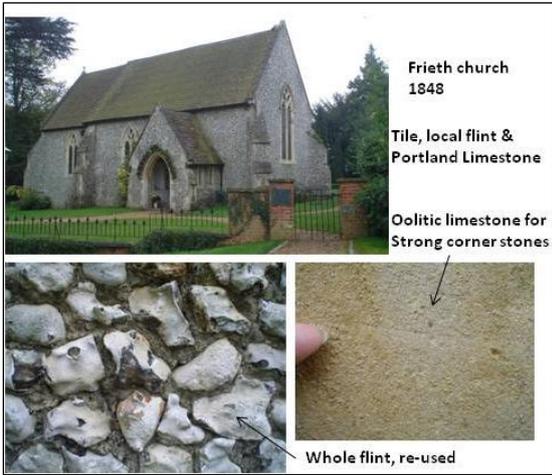


Ivinghoe Church in the centre of Ivinghoe village displays many local stones, plus repairs to the cornerstones in Portland Limestone from Dorset.



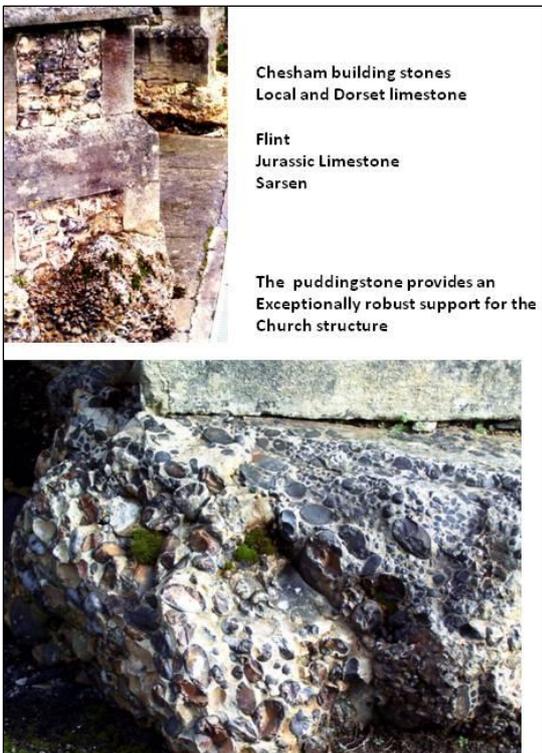
Flint

Flint forms in the upper levels of the Chalk. It is made from silica (very fine quartz) and hence it is very hard. A result of its strength and durability, but also its widespread occurrence, it is a very common building material in the Chilterns. Builders have produced many attractive ways of laying the flint with other rock, such as alternating with Chalk rock blocks in the 'chequer-board' cottage, left or as in Ivinghoe church, above or Frieth Church below.



Sarsen

Sarsen is also a rock made of pure silica (quartz) and hence it is also very strong. It is not a surprise therefore that sarsen finds its way into many buildings – either as building blocks inserted into the main structure as in the two examples below in Princes Risborough and Bradenham, or large blocks may actually be used as a foundation stone and have a whole structure built on top (e.g. St Mary’s church at Chesham).



Sarsen comes in two main forms: a sandy type and a pebbly type. The sandy type is found in many Chilterns locations, but a large exposure which was exploited for many years was quarried at Denner Hill, Bucks. The Denner Stone setts found their way into many a Chilterns town centre. The pebbly types are conglomerates – rounded quartz pebbles surrounded by sand and cemented by quartz. Each is named after the place it is found e.g. Bradenham Puddingstone or Hertfordshire Puddingstone. It is amazing to think that this rock formed within rivers which rapidly brought in sand and pebbles, only to rapidly dry up in the intense heat of a Kalahari-like environment about 40 million years ago.

Cobbles, pebbles and conglomerate

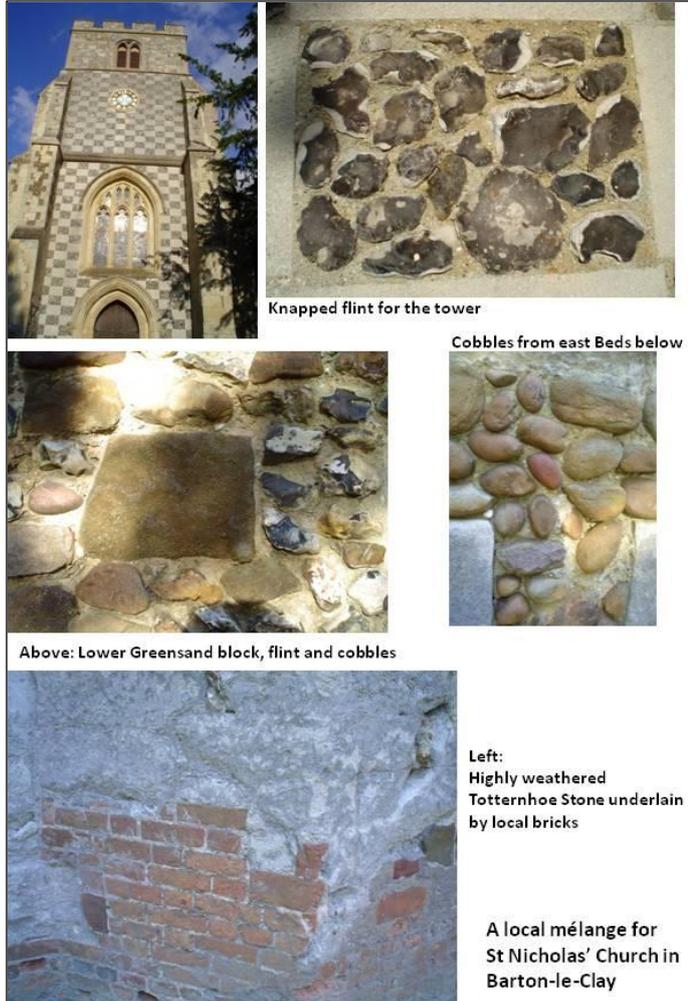
There are isolated sources of a variety of pebbles, although cobbles of a useable size only seem to be found in east Bedfordshire and hence of use in buildings nearest to that localised source.

St Nicholas' church in Barton-le-Clay is a lovely example of the use of anything local that is strong enough and can be used in a built structure!

Cement

Cement is an important resource for building in not just the Chilterns, but across the UK. It is what binds all other building materials together and has been used in the Chilterns since Roman times.

It requires Lower Chalk with a little Upper Chalk, plus a little sand and other ingredients. Cement works such as at Kensworth, Beds or Castle Cement at Pitstone in Bucks, were always sited near the bulk ingredients therefore they are always located at the foot of the Chalk escarpment of the Chilterns. The College Lake nature reserve site of today (see below) is an excellent example of a previous extractive industry which has gone on to provide a local wildlife opportunity.



College Lake, a disused chalk quarry, now flooded as a lake and nature reserve, Pitstone.