

Geology reveals ancient environments

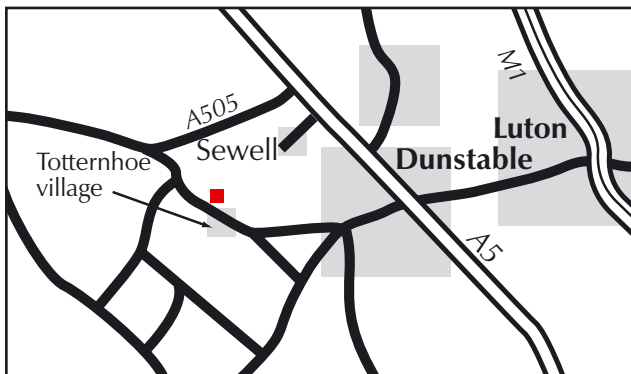
The Chalk that rises high in the south of the county is our legacy from the Cretaceous period, when Bedfordshire lay under a tropical ocean at the same latitude as the Bahamas today. If you look at a chalk face, you'll see changes in the composition of the chalk that reflect changes in the ocean in which it was deposited. In the Cenomanian stage, midway through the Cretaceous, sea levels fell dramatically across the globe. In what is now England the sea retreated to a channel about 9m deep between Buckinghamshire and South Norfolk. This channel filled with chalky sediment washed from higher ground which became compacted and chemically altered over time to become the Totternhoe Stone.

The regional *facies* (layer) is the base of the channel, with *bioturbation*, trace fossils such as the burrows known as *Thalassinoides* made by an animal we've never seen as a fossil. This suggests a peaceful period before the deposition of the Totternhoe Stone. Small particles of limonite (oxidised marcasite, a type of iron sulphide) are found in the lowest 0.5m of sediment.

At Totternhoe a channelised facies lies above the regional facies. It shows no *bedding*, the horizontal layers that record sediments laid down over time. Instead cracks and fissures possibly caused by weathering as dry land zig-zag down through the coarse sediment, which contains many fragments of *Inoceramus* shell and some from the brachiopod *Orbirhynchia mantelliana* but very few fossils left by animals living in the channel. Above this layer the sediments grow finer and contain shark teeth, followed by ray teeth, then rare ammonites near the top of the deposit.



The channelised facies at Totternhoe Quarry.



Totternhoe village and the Totternhoe Lime & Stone Co. quarry lie just east of Dunstable. There are good views into most places of interest bar the working quarry itself from public rights of way in Totternhoe parish. The stone may be seen used to advantage in Woburn Abbey, and All Saints' Church, Houghton Conquest.

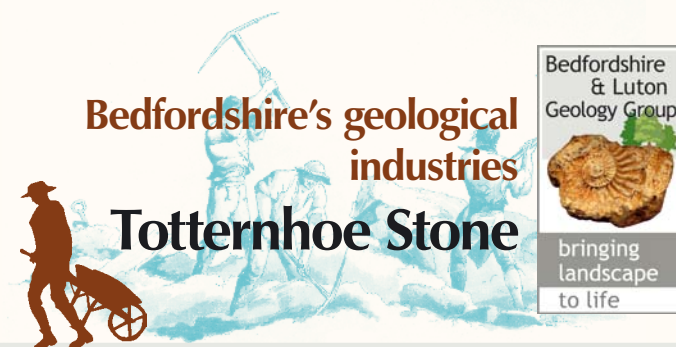
The Bedfordshire & Luton Geology Group exists to encourage understanding of the geology and geomorphology of the county and to undertake site recording, interpretation, advice and education

Regionally Important Geological and Geomorphological Sites (RIGS) are places that reveal our geological past and are considered important enough to deserve conservation. They include sites where rocks can be seen (such as quarries and road cuttings) or where the geology or geological processes can be inferred from the shape of the landscape. Official RIGS are recognised by county councils and by Natural England.

For more information about the BLGG and our events as well as the geology and geomorphology of your area visit our website at

www.bedsrigs.org.uk

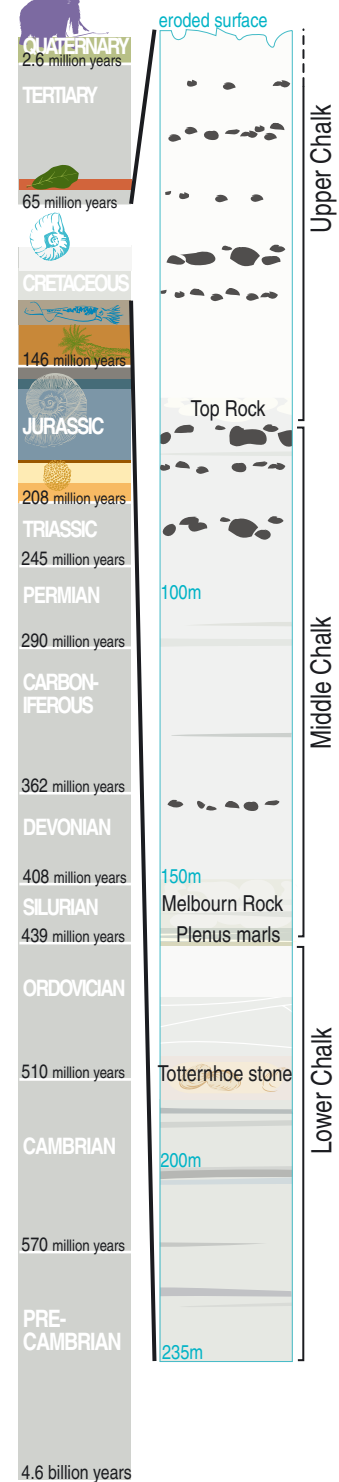
or contact B&LGG c/o Bedford Museum,
Castle Lane, Bedford, Bedfordshire MK40 3XD.
Tel: 01234 353323; Fax: 01234 273401



For nearly 2000 years stone from this quarry has been built into abbeys, churches and royal palaces.

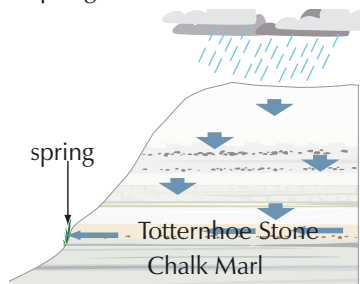
Some of Bedfordshire's finest buildings rely on a building material created by changes in sea level and undersea mudslides more than 90 million years ago: the Totternhoe Stone.





Where can the Totternhoe Stone be seen?

The regional facies (see the back panel for an explanation of this) forms a *hard ground* (hard layer) in the Chalk varying in thickness from less than 1m thick in Buckinghamshire to just under 2m thick in Norfolk. The channelised facies reaches a thickness of 7m at Totternhoe where it forms a massive grey-brown *calcarenites*, a limestone formed of shell or coral sand, or sand eroded from older lime-rich sediments. As the Totternhoe Stone is harder than the surrounding chalk it sometimes forms a faint ridge or shelf low on the north-facing chalk escarpment. Look for springs issuing from the ridge: the Totternhoe Stone is an *aquifer*. Rainwater percolates through the Chalk until it reaches the impermeable Chalk Marl blocking further downward movement. The water then flows through the Totternhoe Stone to emerge as hillside springs.



Look inside buildings, too!

And on archaeological sites as well: the Totternhoe Stone is Bedfordshire's most famous building stone. The quarries at Totternhoe have been worked for nearly 2000 years: a block was found in the Roman Road that once ran under Edgware Road in London, and a large villa at Totternhoe itself had internal walls of Totternhoe Stone.

The Romans recognised the stone's weakness: as water can flow through it, Totternhoe Stone is very vulnerable to erosion and weathering. The 'green' freshly quarried stone is grey in colour, relatively hard and very wet. Left to stand for a short period it becomes soft and, as a *freestone* with no bedding planes, very suitable for dressing and decorative carving. Once worked it is left to dry completely and harden: if worked when dry, the stone will shatter. As it dries the colour lightens until the stone is almost white.

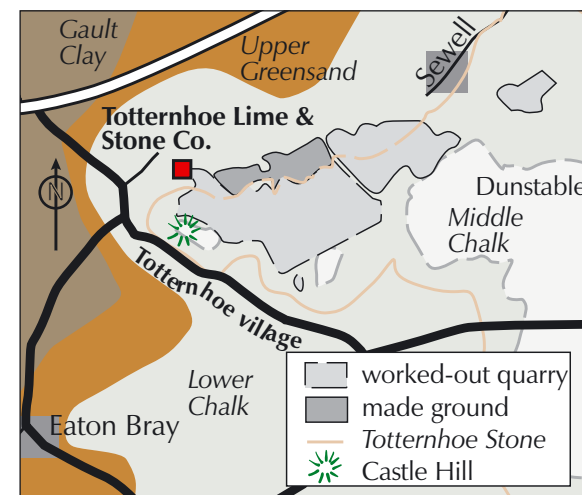
In 1132 Henry I endowed a new monastery at Dunstable with a valuable property '*... de Tothenho, et quadrarium eiusdem villae*'. Under Henry II 100s 8d was paid for 'stones from Eglemunt sent for the work of the King's houses of Windsor'. *Eglemunt* or 'eagle's hill' was a Norman name for Castle Hill standing above the quarry.

Production from the Totternhoe quarries peaked between the 12th and 16th centuries. Work at Windsor continued (the light, porous stone was particularly suitable for vaults such as that of the treasury), but stone was also shipped to Westminster. Many local churches and other important buildings made use of this lovely white stone. Demand declined after the dissolution of the monasteries in the 16th century. By the 20th century Totternhoe quarry was producing lime rather than stone



Totternhoe Stone in the church of St Giles, Totternhoe.

(lime kilns can still be seen on site). Some years ago the Duke of Bedford arranged for a stonemason working on Woburn Abbey to re-open the stone pit to provide Totternhoe Stone to repair historic buildings.



Over the centuries the Totternhoe quarries have dramatically altered the landscape. Workers began by removing the overlying chalk to expose the Totternhoe Stone. As demand grew in the Middle Ages the workers started to mine the stone, driving *adits* (horizontal passages) into the hillside between Totternhoe and Sewell. The made ground east of the current quarry ('Rat's Holes Pits' and 'Quarry Pits') is the spoil from these adits. The Totternhoe Knolls Nature Reserve lies on the spoil from adits extending under Castle Hill, the entrances to which are lost. Local legend has the adits running 2 miles to Dunstable, but a quarry worker said in 1949 that the longest ran about 0.25 mile. The adits resembled 'a gallery supported by pillars of *clunch* [chalk] varying in thickness from 18" to 6', square or rectangular in section'. The effect was of a maze or labyrinth in which it was extremely easy to become lost.

In the 1980s 'Hunger Hill', which once stood east of Castle Hill, was completely quarried away for cement and lime. The worked-out quarry is now an arable field lying at the level of the upper surface of the Totternhoe Stone.