The Geology of the Burton Dassett Hills Country Park

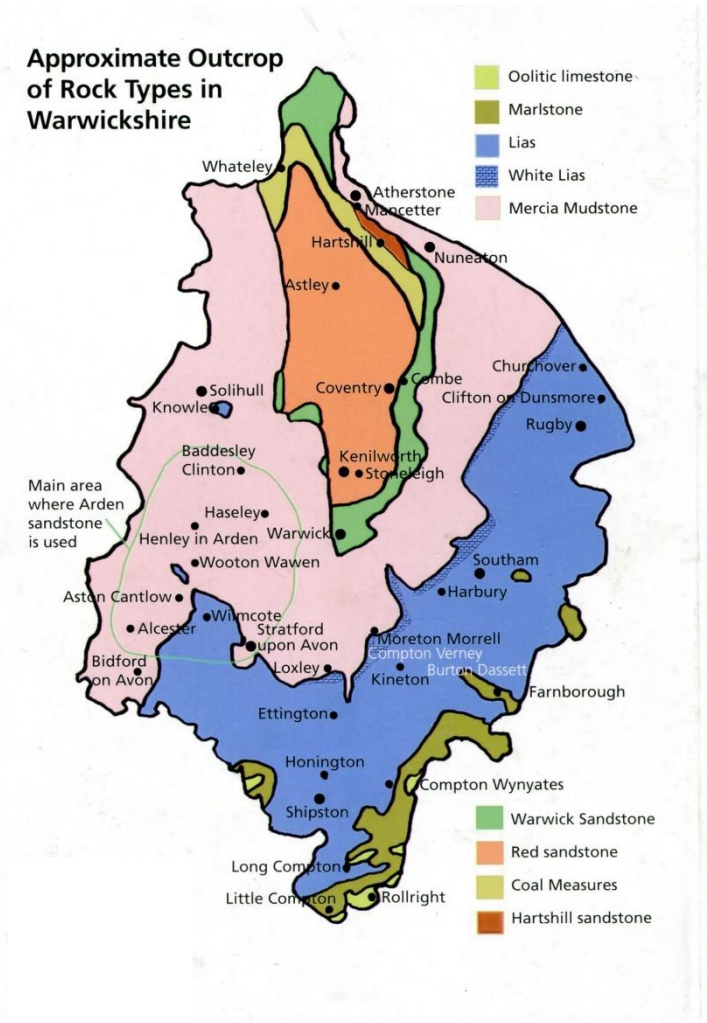
Introduction

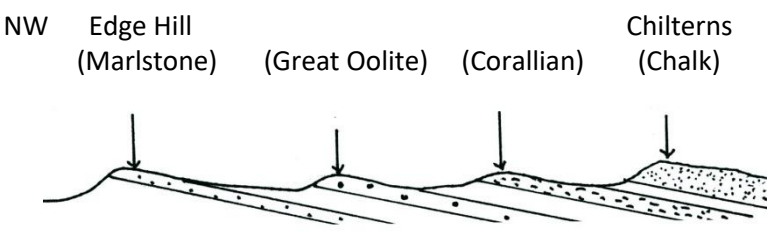
The Burton Dassett Hills in South Warwickshire cover a 100-acre site, which was designated as a country park by Warwickshire County Council in 1972. Much of the higher ground in the park shows the scars of ironstone quarrying. As well as the spectacular views and opportunities for outdoor activities, there is historical interest including a 12th Century Church, the site of a Saxon graveyard, ancient springs, ridges and furrows and the Beacon, a tower made from blocks of ironstone, which was probably built in the 15th Century. It may have had a communications function by lighting fires, been the base of a windmill or perhaps a Warrener's lodge: the home of a rabbit catcher.

The rocks that outcrop in the south and east of Warwickshire are mainly of Lower Jurassic age (formerly called the Lias) These Liassic rocks, mostly from the Lower Lias, are dominated by mudstones but also contain 2 limestone formations – the White Lias and the Blue Lias. This large area (blue on the map opposite) forms the clay lowlands agricultural region of the Warwickshire Feldon.

On the fringes of these lowlands are exposures of Middle Lias and Upper Lias and, in the south, small areas of Middle Jurassic rocks. The higher ground here is largely the result of the greater resistance to weathering and erosion of the sandstones, siltstones, limestones and ironstones present.

Over the county border in Northamptonshire, Oxfordshire and Gloucestershire, the full extent of the hilly scenery of the Cotwolds and other Hills demonstrate the gentle regional dip of the Mesozoic rocks to the south east. Jurassic rocks eventually disappear below younger Cretaceous rocks. Where rocks that are more resistant, such as the four labelled in the sketch section below, there is higher ground. The lower ground is formed of the less resistant rocks, often clays, which weathering, rain and rivers remove more easily. The tilting creates steep slopes when the rocks are 'end on'. There is often a resistant 'cap rock' on the top of the escarpment, such as the Marlstone at Edge Hill, protecting less-resistant rocks underneath.





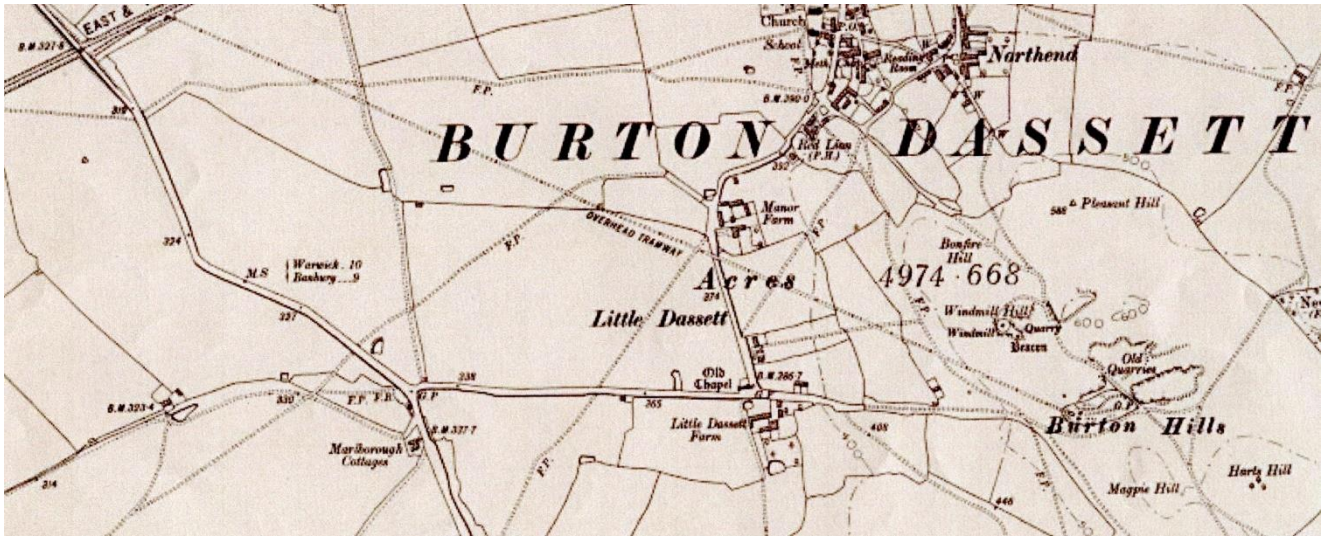
Sketch geological section across Oxfordshire

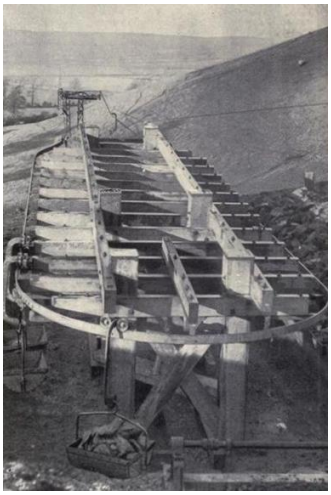
A History of Ironstone Quarrying

The rusty brown rock that was extracted has several names:

- Marlstone Rock Bed or Marlstone Formation; this is its scientific name,
- Hornton Stone; this is one of the names for the building stone from which many houses in North Oxfordshire and Southern Warwickshire are constructed,
- Banbury Ironstone; this is because the iron content was just enough (a rarely achieved maximum of 30%) for it to be used as a raw material for the iron and steel industry. It was usually sent from the area to South Wales.

The removal of blocks of the rock for a building stone has probably taken place here for many centuries, but commercial quarrying took place on the Burton Dassett Hills intermittently between 1865 and 1876, between 1898 and 1912 and between 1918 and 1925. Although the iron ore was easy to work and had a high lime content, the small area of workable stone and the difficulties of transporting it to canal or railway station made the economics of quarrying dependent on demand and on a high price for the ore. Up to 53 people were, however, employed at maximum. For most of the life of the quarries, horses pulled railway wagons along tracks, constructed from the rock faces, to a collecting point at Gallow's Hill (west of the toilets). Abandoned wagons were still around in the late 1920s. A steam locomotive was tried for short time. After initially taking the ore downhill by pack horse to Fenny Compton and its canal basin to the east, steam-driven aerial ropeways were constructed to carry the ore in buckets downhill before its arrival at a main road or the rail head at Burton Dassett Sidings alongside the Warwick to Banbury Road.

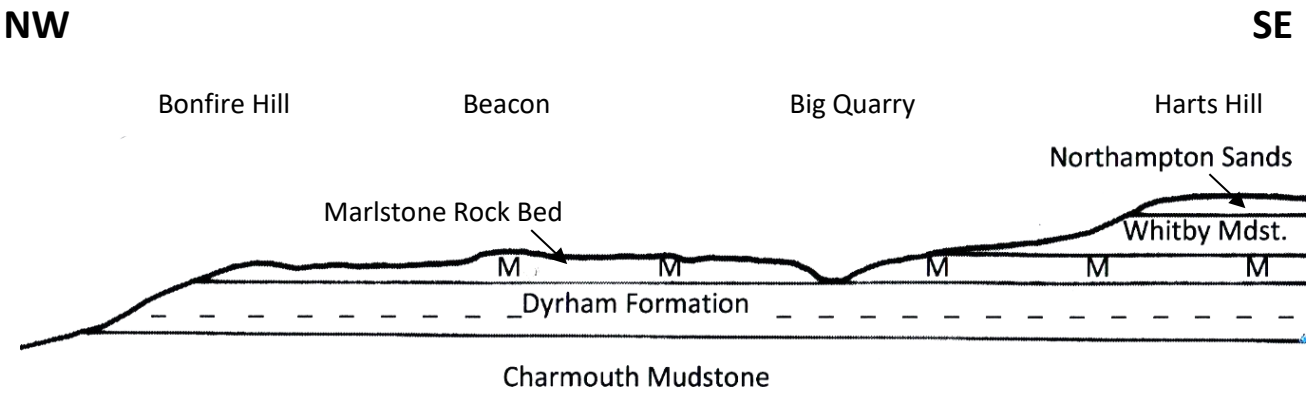




The 1904 Ordnance Survey map and old photographs showing the aerial ropeway

The production of iron ore from the Burton Dassett Hills was tiny compared with quarrying at other locations in the area, where extensive open cast methods were employed. The decline of steel making in the U.K. in the 1960s finally led to the closure of all but a few local quarries now satisfying only an intermittent demand for building stone and road stone.

Jurassic Rock Types of the Burton Dassett Hills



Sketch geological section across the Burton Dassett Hills

Northampton Sand Formation
This is found at the top of Harts Hill. A lack of significant fossils has meant that the rock cannot be dated very accurately but, lying above the Whitby Mudstone, it appears to belong to the Middle, rather than the Lower Jurassic (Aalenian faunal stage) The main rock is a calcareous sandstone, sometime ferruginous.

Whitby Mudstone (Upper Lias Clay)
The outcrop shows a 'ridge and furrow' surface on the lower slopes of Harts Hill. These muddy rocks have their equivalents in such places as Brailles, Hanwell and Crouch Hill, Banbury. They belong to the Upper Lias (Toarcian faunal stage) but investigations in the South East Midlands suggest a large gap in time between the deposition of the Whitby Mudstone and the deposition of the Northampton Sand Formation above.

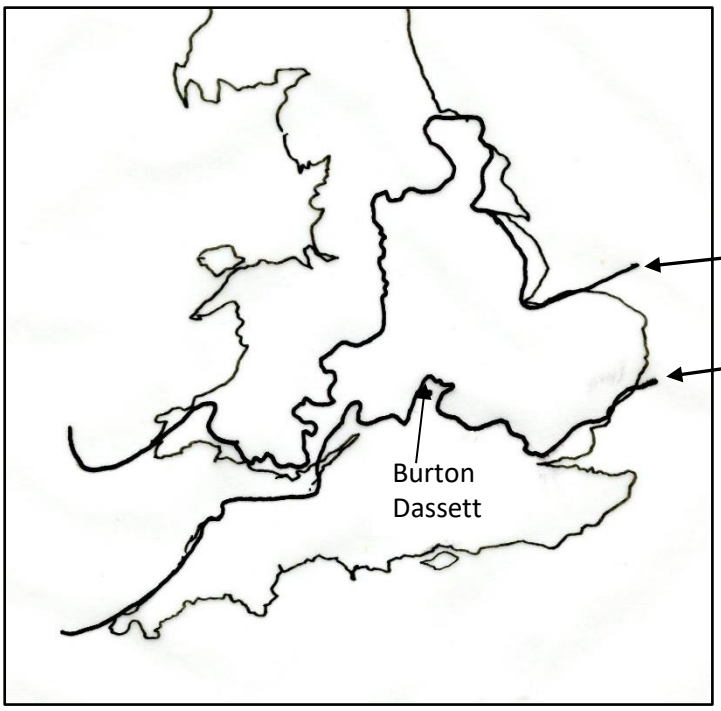
Marlstone Rock Bed
This was the rock that was extensively quarried on the Hills. The Marlstone is extremely variable in its chemistry and physical components, but it contains a variety of fossils, notably bivalves, belemnites and 'nests' of brachiopods. Its thickness also varies greatly between 1 and 8 metres in the local area. At Burton Dassett it is around 6 metres thick. The Formation belongs to the Middle Lias (faunal stage Pliensbachian and possible also Toarcian). There is evidence of stratigraphic breaks both at the top and base of the Formation.

Dyrham Formation (Middle Lias Silts)
The Formation is represented here as siltstones and is occasionally exposed below the Marlstone Rock Bed. The rock consists largely of fine, well-sorted grains and it is often micaceous. Fossils are common; mainly small sea shells. These rocks have their equivalents in the Banbury area where they are frequently found on the slopes around the town centre. They belong to the Middle Lias (Pliensbachian faunal stage).

Charmouth Mudstone (Lower Lias Clay)
This surrounds the Burton Dassett Hills, occupies much of the lowlands in this part of Warwickshire and Oxfordshire and extends along the valley of the River Cherwell to Banbury Town Centre. The dark-coloured mudstones contain several thin limestone strata. As in Dorset, the Charmouth Mudstone is fossiliferous and has yielded Warwickshire's famous Plesiosaur and Ichthyosaur skeletons. The Formation belongs to the Lower Lias (Sinemurian and Pliensbachian faunal stages).

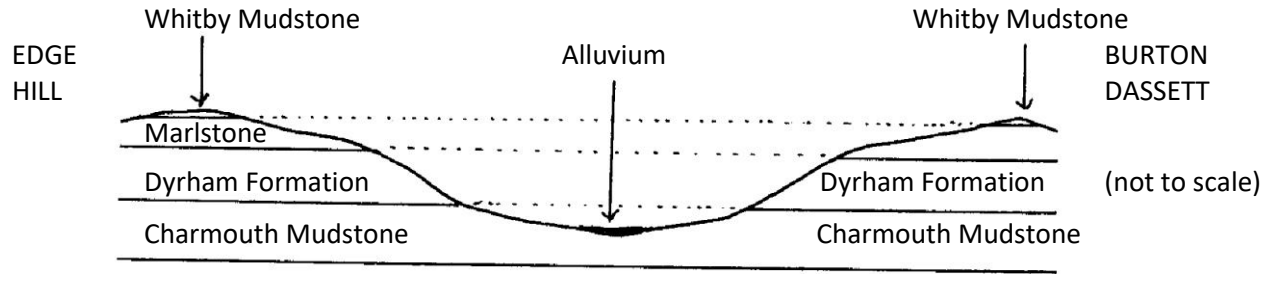
The Formation of the Burton Dassett Hills
Following intermittent deposition of marine sedimentary rocks during the Jurassic, sedimentation would have continued throughout the Cretaceous and into the Cainozoic over the whole of the Midlands. Alpine earth movements and the opening-up of the Atlantic Ocean led to uplift of the area and a gentle regional tilt to the south east. The dip of rocks, however, can vary locally both in angle and direction of dip. Faulting has also taken place and slickensiding can be observed on some rock surfaces. Many millions of years of erosion has stripped away younger rocks to expose the Jurassic once again. Outcrops migrate south-eastwards with continued erosion. Once the cap of more resistant Marlstone Rock is eroded from the hill tops in the area, the landscape is lowered as the rocks below it are quickly removed and the scarp slopes such as at Edge Hill, have continued to retreat in the direction of dip.

Burton Dassett and the Pleistocene



The flint-rich tills, deposited by North Sea ice sheets, that cover many hills in Northamptonshire and Buckinghamshire to the east, are absent in the Burton Dassett area but there are local patches of till, especially in the Gaydon and Kineton area, whose clasts of Triassic rocks suggest an origin from Irish Sea ice sheets. Both tills are attributed to the Anglian glacial period rather than more recent glaciations. There are deposits of head on the western slopes of Beacon Hill, attributed to solifluction under periglacial conditions. With Warwickshire on the fringes of ice sheets during colder periods of the Pleistocene, volumes of meltwater would have been significant.

River erosion has led to the large gaps in the ironstone escarpment that can be easily viewed from the Burton Dassett Hills. The Dassett Gap to the west (used by M40 motorway) and the Fenny Compton Gap to the east (used by the Oxford Canal) merge near Banbury to form one valley. As a result, a curved linear outlier of Jurassic rocks over 10 kilometres long has been formed between the two gaps. The Burton Dassett Hills lie on its northern tip.
The Fenny Compton Gap is currently occupied by the River Cherwell but the Dassett Gap is a minor watershed with tiny streams flowing both northwards into River Avon and southwards into the River Cherwell.



The sketch above shows that the rock layers of Lower Jurassic age were once continuous between Burton Dassett and Edge Hill. A wide valley of the Dassett Gap has been cut down at least 50 metres into these rocks, but there is no big river in between to have formed it. Its origin cannot be attributed to present-day surface processes so must be linked to glaciations in the Pleistocene. We know that ice both from the Irish Sea and North Sea crossed parts the Midlands and left debris when it melted. Water pouring off a melting ice sheet could have been dammed both by the ice sheets and by local hills, possibly creating lakes covering parts of Warwickshire and Leicestershire. If these lakes overflowed, there would have been plenty of extra water to cut the valleys west and the east of the Burton Dassett Hills. The River Cherwell, like so many in North Oxfordshire, is described as 'misfit' because its current size does not match the large valley it occupies.

Further information

Warwickshire Geological Conservation Group

Hidden wonders in the landscape of Warwickshire

WGCG, whose membership extends well beyond the borders of Warwickshire, offers talks, field trips, outreach events and conservation activities Details of all its Local Geological Sites (LGS), along with all other information about the organisation, can be viewed on its website at www.wgcg,co.uk. The Burton Dassett Hills are No. 33 in a total of over 80 LGS.

The **1:50,000 geological map** covering the area is Sheet 201 Banbury. The accompanying Memoir was published in 1965 and can be viewed online at the BGS website www.bgs.ac.uk.

A detailed article on **Warwickshire's Jurassic**, written by WGCG member Jon Radley, can be found online at **www.emgs.org.uk**. in Mercian Geologist 2003 Volume 15 p.209. He was also written an article for the general public about the Hills at www.ourwarwickshire.org.uk.

School Project Teacher's Pack, an introduction to the geology of the Burton Dassett Hills for Primary School teachers, can be downloaded from the WGCG website.

Warwickshire County Council has produced various leaflets about its country parks over the years. The most useful, sponsored by the Rover Group, is sadly no longer available.

The Ironstone Quarries Of The Midlands Part Two The Oxfordshire Field by Eric Tonks 1988 ISBN 978 1 907094 01 9 provides details of the ironstone quarrying at Burton Dassett as well as other quarries in Oxfordshire, Warwickshire and Northamptonshire.

A Walk Along the Ironstone by Chris Hone 2017 ISBN 1-908738-28-8 is a recent book about the ironstone quarrying in the Wroxton area, west of Banbury

The Geology of Oxfordshire by Philip Powell 2005 ISBN 1 904349 19 6

Northamptonshire Stone by D.S Sutherland 2003 ISBN 1 9044349 17 X

Natural History Museum, London, ***Mesozoic Fossils*** 2001 ISBN 1 898298 73 4 illustrates common fossils of the area.

A Ramblers' Guide to Building Stones in Warwickshire by Hugh Jones (WGCG) 2006 ISBN 978 0 9571232 0 5