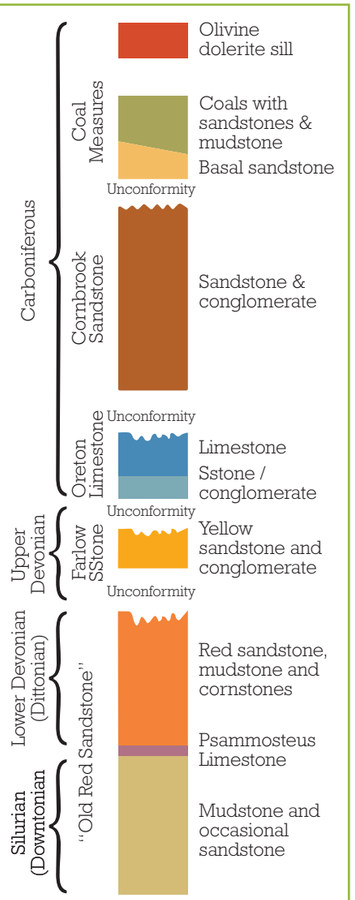


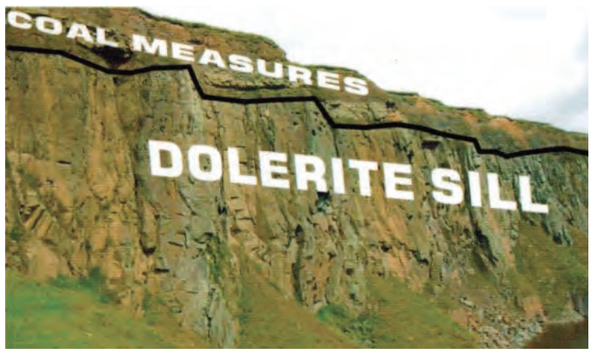

*Stratigraphic column as key to the map.*

## B SO 595 756 Observation Point for Incline Quarry

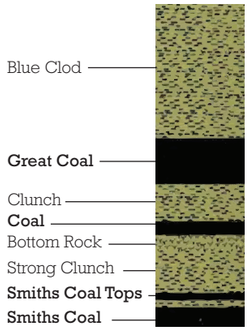
You step out onto a recently constructed viewpoint, looking down the length of the most spectacular cliff in Shropshire.

Here you can clearly see how the horizontal sill of the Dhustone underlies the layers of clay and sandstone. This coal seams remain here above the sill, protected in a slight dip in its upper surface. Elsewhere the surviving coal seams are all beneath the Dhustone sill. Note that the sill has a distinctively columnar structure with vertical joints, reminiscent of the Giant's Causeway, though the latter is an extruded lava flow. Jointing was caused by contraction of the rock as it cooled.

**DO NOT CLIMB THE GRASSY BANK TO THE CONTACT ZONE.**




☛ *Return through wicket gate and turn left. Follow track alongside lake to main quarry road. Then EITHER - turn right and follow quarry road back to A4117 and car park. P1. Take car approx 1.5km to P2 where you can park on the verge on the south side.*



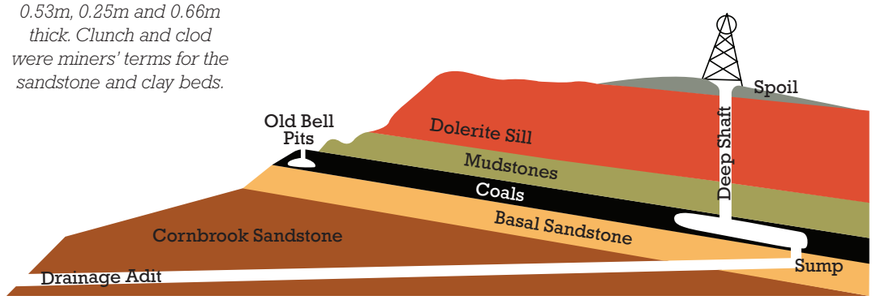

*The bottom 12m of the 74m deep shaft at "New Pit" as drawn on a 19th century section in Ludlow Museum. The four principal coal seams were 1.6m, 0.53m, 0.25m and 0.66m thick. Clunch and clod were miners' terms for the sandstone and clay beds.*

*If visibility is good follow quarry road towards plant for about 150m. At fork bear right then take metalled track off right side, steeply down into valley below. As this track turns sharp right, you keep straight ahead on little more than a sheep track, over small stream and up hill ahead to the top of the spoil heap.*

## C SO 602 761 Spoil Heap - Remains of the Barn Pit

The ground here is uneven due to spoil heaps from coal mining. This was typical of the late 19th and early 20th century workings. There were four main seams of workable coal in the Coal Measures of Clee Hill, ranging from 0.6m to 2m thick (see figure to left), with layers of sandstone, shale and clay in-between. Fragments of coal and shale, along with traces of plant remains can be found in the spoil. The shaft is about 70 metres deep. It was capped in the 1940s. These deep shafts were dug through the hard sill (see diagram below).

☛ *From the spoil heap various paths and tracks lead north eastwards, past other spoil heaps, before a main pathway turns south towards the main road at the alternative car park P2.* ***Pursue this route only if visibility is good and you have a footpath map.***




*Diagrammatic section of Clee Hill showing different ways of exploiting the coal.*

☛ *From P2 take roughly metalled track down into Cornbrook Dingle to where the track crosses the stream.*

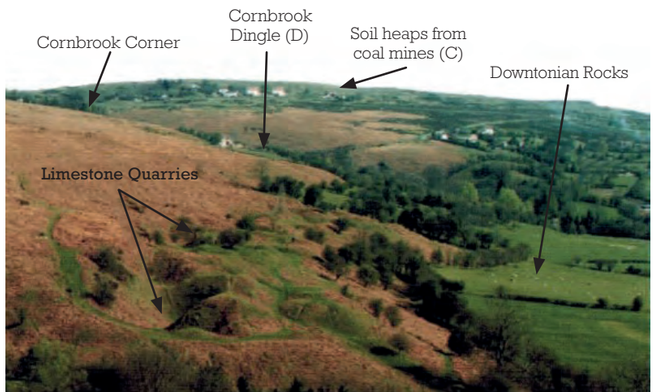
## D SO 603 755 Cornbrook Dingle

Looking upstream a drainage adit on the east bank is discharging iron-stained water from the drainage adit of the abandoned coal mines under the hill above (see diagram above). The bright colour arises from the oxidation of iron pyrites, a common mineral in Coal Measures strata, and from bacteria which thrive in the warm, iron-rich acidic water. Upstream of the adit are outcrops of the sandstones and conglomerates that make up the Cornbrook Sandstone

Downstream, the rough ground on the valley floor marks the remains of an 18th century iron furnace. Power for the bellows came from a water-wheel fed by the mill leat that can still be seen. The ore for the iron making came from ironstone concretions occurring in Coal Measures mudstone.

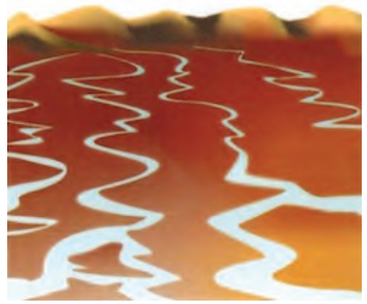
☛ *Over the stream take the path up and in front of the cottages then follow the downward path south westward.*

This path passes the pits and mounds, which are old quarries in Oreton Limestone, lying beneath the Cornbrook Sandstone.




# *Imagine...*

...that you were standing on this piece of the Earth's crust 400 million years ago. You would have been very near the Equator, on a huge delta crossed by a complex river system. The much eroded remnants of a once high mountain chain lay to the north. South of the 'Bristol Channel' was an ocean. The sediments brought down from the mountains were spread around as a vast delta of what we now refer to as the Devonian or Old Red Sandstone.



Stay on this spot and you would have been carried slowly northwards by the drifting of the continental plates. By 360 million years ago, as you pass through the northern Equatorial belt, you will have sunk beneath the waves of a clear, shallow sea with abundant corals, brachiopods and other shelly creatures. Their fossilised remains sank to produce beds of limestone on the sea floor: the Oreton Limestone.

To the south the sea deepened gradually into a large basin in which layers of calcium carbonate accumulated as the Carboniferous Limestone of the Avon Gorge and Mendips. But northwards the shore was very close. A neck of higher land crossed 'Shropshire' from Wales to the Midlands. To the north of this, another sea spread up into the Pennines.

Further gentle uplift raised new mountains. These eroded to fill the Carboniferous Limestone basins with coarse sand and gravel: the Millstone Grit of the Pennine area. Here the Oreton Limestone was covered by Cornbrook Sandstone.

Over this, while still drifting north through the Equatorial belt, vast coastal swamps developed, in which ferns and their allies, and the ancestors of our modern conifers, grew luxuriantly and to huge size (see front cover). Rising sea levels buried decaying plants in layers of mud and sand before retreating and allowing the swamps to regrow. Thus the Coal Measures developed with seams of coal separated by clay and sand.

This continued over a vast area of the West Midlands, until a further mountain building episode threw the Earth's crust into a series of folds. In most areas the weak Coal Measures rocks were eroded away from the upper parts of the arched folds. But here the coal bearing strata is preserved on the highest hills in Shropshire, giving the most elevated coalfields in the British Isles. The key to this lies in the Dhustone (from Welsh ddu = black) - the resistant, blue-black crystalline dolerite rock that caps all the Clee Hill summits. This once-molten rock squeezed between the layers of soft sediment of the Upper Coal Measures during a period of volcanic activity at the end of the Carboniferous Period. Such was the volume of molten magma produced, that it gave rise to a layer of rock in the form of a sill, about 50 metres thick.

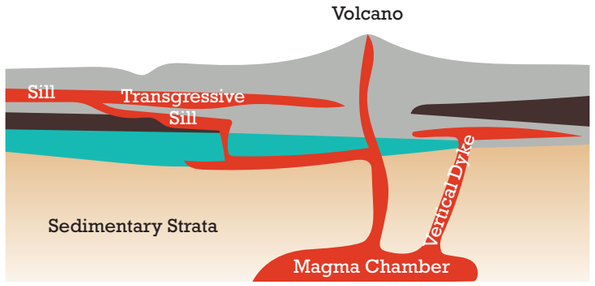
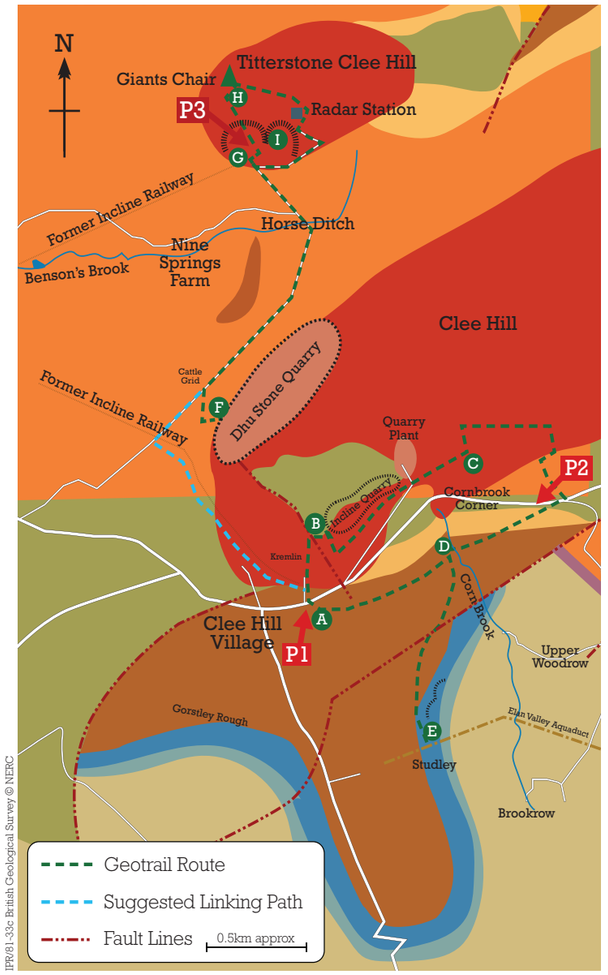



*Diagram to indicate formation of a sill during volcanic activity*

After 300 million years of further ups and downs of land a sea, and continued northerly drift to our present latitude, remnants of that sheet of dolerite still protect the Clee Hills and the sequence or Carboniferous rocks that lie between them.






To help you piece together this story for yourself, whilst exploring Clee Hill and Titterstone Clee, the following trail has been devised. For convenience the route has been split into two sections - south and north - but these can be joined by the use of additional footpaths, such as the suggested route marked in blue on the map above. The use of the OS Explorer Map 203 is very strongly advised.

Alternatively, if you wish to shorten the walking distance, if the visibility is poor, if you are in doubt over your map-reading skills, or if you simply wish to see the geological locations on different occasions then use alternative parking places. But please ensure always that your car is parked where it won't obstruct residents or farmers.

# Southern Section: Locations A to E

## A SO 595 753 Cleehill Village Car Park by cattle grid on A4117

☛ *Walk 100m east to viewing platform (596 753).*

Below you is a broad spread of Cornbrook Sandstone, edged by an escarpment of Oreton Limestone. Below and beyond the base of the Carboniferous is the Old Red Sandstone with its characteristic red soils, stretching into Herefordshire and south west to the Brecon Beacons. Older Silurian Rocks have been faulted upwards through the Old Red Sandstone to form the Abberley Hills and the ridges behind Ludlow that turn to sweep north eastwards as Wenlock Edge.

☛ *Retrace your steps to the car park. Cross A4117 with great care. Go up lane and past Kremlin Inn car park take track to right. Go through gate and on about 50m. 'Turn left and through the gate to the viewing area.*

# Titterstone Clee and Clee Hill GEOTRAIL

This trail was devised as a walking route. However, to cover the ground and study the geology will take a very full day for fit walkers and possibly 2 days at a more leisurely pace. It can be treated as a figure-of- eight based on the car park at Cleehill village. Cars can also be used to reach, or get near to, a number of the sites. Please park with consideration for others and in particular do not block access to property or fields.

Much of the trail crosses rough and exposed moorland and weather conditions can change rapidly on the hill. Be prepared: bring a good map, adequate clothing and appropriate footwear.

## Facilities for the GEOTRAIL

| | |
|---|---|
| **Parking:** | Car park at the top of Cleehill village on the east side of the cattle grid and Titterstone Clee Quarry |
| **Start:** | Cleehill village car park (SO 595793) for locations A-E.<br>Titterstone Clee Quarry car park (SO 593775) for locations F-I |
| **Length:** | Southern section approx. 5km<br>Northern section approx. 6.5km |
| **Refreshments:** | Cleehill village has two inns and a cafe. There is an inn close to the route at Studley |
| **Toilets:** | Cleehill village |
| **Map:** | OS Landranger 138; OS Explorer 203 |
| **Terrain:** | Tracks, field paths, some roads |

**This GEOTRAIL** is an edited version of the more extensive *Geological Trail for Titterstone Clee and Clee Hill* by Michael Rosenbaum and Brian Wilkinson, 2005.

Designed by Scenesetters. Topographical detail on maps derived from copyright expired maps and field survey.

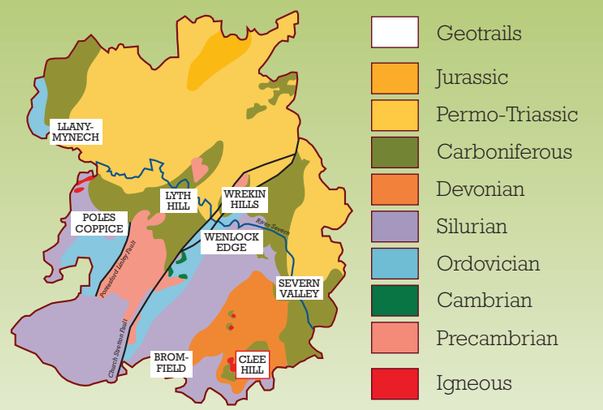
**The Shropshire Geological Society** is a registered charity (no. 1098511), founded in 1979. It welcomes membership from anyone interested in Earth heritage or the conservation of Shropshire's geology.

For a copy of the full trail, information about the Society, other geotrails, or geological events see website:
**www.shropshiregeology.org.uk**

### Disclaimer



### Explore Shropshire's rich geological diversity on a Geotrail




GEOTRAILS SHROPSHIRE GEOLOGICAL SOCIETY

**Supported by DEFRA's Aggregates Levy Sustainability Fund Grant Scheme administered by Natural England**

NATURAL ENGLAND

## E SO 600 747 Studley

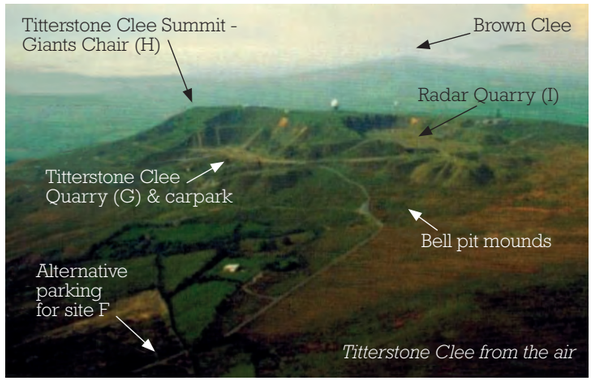
As the path drops steeply towards Studley the quarries on your left that fed into the 19th century Studley Lime Works become larger. Small pieces of Oreton Limestone are easy to find but there is very little exposed rock. Fragments of fossil shells and crinoids may be seen. This limestone was formed in a shallow, relatively clear sea near the equator about 350 million years ago.

This was an important source of limestone in the Clee area. It was quarried extensively over most of its outcrop and used to prepare lime for mortar for buildings, as a soil improver and as a flux for local iron smelting. Generally quarrying ceased as it became uneconomical to remove the overlying strata to reveal the limestone. However in some places (e.g. Knowle Wood) the limestone workings were extended by tunnelling.

☛ *From Studley retrace your steps towards Combrook Dingle. Take the path left in front of the cottages and follow this back to the car park (P1) at Clee Hill village (or of course return to P2)*

# Northern Section: Locations F to I

☛ ***EITHER** now proceed to the Titterstone Clee summit car park P2, signed off A4117 about 1km west of village; OR on foot, cross main road and follow the line of the old railway (path marked in blue on map) until you reach the summit road to start the next section of the trail. If by car, park very briefly by the cattle grid to go up to the Dhu Stone Quarry viewpoint (F).*



*Titterstone Clee from the air*

## F SO 590 762 Dhu Stone Quarry Viewpoint

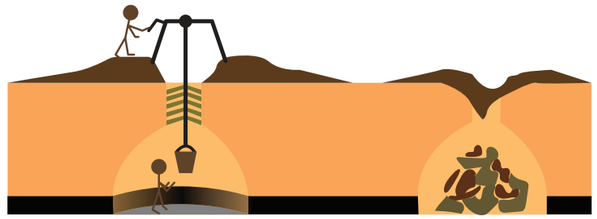
Here you look into the active Dhu Stone Quarry (see photo below) The Coal Measures can be seen overlying the dolerite sill to the left of the main access road to the quarry. A fault is visible along this main access road dropping the sill down to the left (north). The sill shows an extensive weathered profile to the right (south) of the fault. At this locality the sill lies within the Coal Measures, but, below the summit of Titterstone Clee, it appears to intrude into the Old Red Sandstone. It is likely that the sill once extended as a continuous sheet between the Clee Hills (including Brown Clee) but has since been eroded away.

The rock excavated here is used in the aggregates industry, mainly as road stone. The first use of it locally was the paving setts used in Ludlow in the 19th century. Prior to this the Dhu Stone was just considered a nuisance as it covered the then much more valuable coal.

☛ *Return down steps to midway display board to take in the view of the Ludlow Anticline and Mortimer Forest. Then return to the road and proceed on (or back) to the summit car park.*

*View from Dhu Stone Quarry view point*


As you continue to drive/walk along the road to the summit you are crossing the Coal Measures and will see spoil heaps from mediaeval bell pits on the west side of the road. These bell pits are Scheduled Ancient Monuments. Orange staining of sediment in the stream bed at Horseditch indicates oxidation of iron pyrites, as in Cornbrook Dingle.


*Diagrammatic section through a working and collapsed bell pit.*

## G SO 593 775 Titterstone Hill Quarry

The quarry that is occupied by the car park is a prominent excavation in the dolerite sill. The remains of the quarry plant can be seen, as can the embankment for the incline railway (built in 1880 and closed in 1954) running downhill to the south west.

The 19th century technique for breaking the larger blocks of rock in the faces of this quarry was to light fires against the face then quench the heated rock with water to shatter it. This protected the stone from undue fragmentation but resulted in high quarry faces and led to a major collapse in the early 20th century. Following this, explosives were more widely used.


*Stone breaking plant in 1920s*

☛ *Follow Shropshire Way NW from car park to summit*

## H SO 592 780 Titterstone Clee Summit

Glaciations have taken place a number of times during the last 2 million years. The last was during the Devensian (120,000 to 11,000 years ago), with its coldest phase 18,000 years ago. During the Devensian the low ground seen to the west of the Clee Hills was the meeting point of three major glaciers. Titterstone Clee and Clee Hill remained free of the glaciers but experienced permafrost conditions. The boulders of dolerite covering the summit and its flanks show frost shattering caused during the last Ice Age and many were transported downhill to form the broad apron of debris below, now partly obscured by bracken.

☛ *Walk past radar station to road. Follow downhill to quarry.*

## I SO 597 777 Radar Quarry

This quarry provides further exposures of columnar-jointed dolerite. The strong vertical jointing leads to instability in the quarry face and rock-topples, a common mode of failure, can be seen.

☛ *Walk back down the road to reach the Titterstone Clee quarry and car park. If you have walked to this part of the trail either retrace your steps or use your OS map to find footpaths back to Clee Hill village.*

# Titterstone Clee and Clee Hill

## From 300 million year old tropical swamps...


## ... and volcanic activity ...

## ... to coal mines and quarries

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