Prepared for the Cleobury Mortimer Footpath Association

A Walk on Titterstone Clee and Clee Hill with a Commentary on the Geological Features

By

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Cleobury Mortimer Footpath Association walkers on an early autumn walk – Titterstone Clee Hill is on the skyline

These walks over Clee Hill and Titterstone Clee Hill take us through four hundred million years of the earth's history. They start from the end of the Silurian, when life was just beginning to become established on land [about 417Ma (Ma=million years ago)], through the Devonian and the later stages of the Carboniferous [about 300Ma] to the most recent ice age , which ended only eleven thousand years ago. The walking routes, an outline geological map and the geological sequence are shown in Fig. 1. A simplified geological cross section through the rocks from N to S is given in Fig.2.

The walks follow public rights of way or are on common land. Locations of points of particular geological interest are denoted by letters A, B, C etc. The use of the Ordinance Survey Explorer Series Sheet 203 Ludlow (1:25 000 scale) is essential as OS grid references are given in the Walking Guide to assist location. A compass and hand lens (x 10) will be useful but hammers should not be used. Weather conditions on the Clee Hills can be changeable and adverse. Appropriate clothing and footwear should be worn. Visitors should follow the Country Code and the Geologists Code.

The walks cover about 20 km [12.5 miles]. If the whole Route is to be followed two days may be needed .It is suggested that:

Day 1 *- start at Cleehill village Location A and follow Locations B to K in order, leaving the A4117 at 5863 7573 and turning N then E to follow public footpaths back to Cleehill village [Location B] ;*

Day 2 *- start at Cleehill village then proceed through Locations L to W in that order, returning to Cleehill village.*

Acknowledgement: The authors are grateful to Bill Duley for initially suggesting the project, to Daniel Lockett from Ludlow Library for providing some of the Figures, and to Chairman [Steve Parker], Secretary [Alan Kimber] and members of CMFA for their encouragement during the preparation of the walking guide.

A brief geological history

Clee Hill and Titterstone Clee Hill are parts of an isolated block [outlier] of Carboniferous rocks [see the stratigraphic column in Fig.1b]. In some places this rests at an angle [unconformably] on, or is faulted against, older Devonian and Silurian sedimentary rocks. The outlier is some 13 km long and 3 km wide and has a down-folded [synclinal] structure trending NE-SW [Figs 2 & 3].

The Devonian and Silurian rocks, prior to the deposition of the Carboniferous strata, had been affected by earlier folding and faulting due to the huge stresses generated by the collision of two continental plates towards the end of the Silurian period. This collision led to the disappearance of an ocean to the N and W of Shropshire and the land surface rose to create a large mountain chain forming the Old Red Sandstone continent [Fig.4]. This lay to the S of the equator. Weathering and erosion of the mountains formed detritus that was washed down into an extensive region of flood plains and shallow lakes during the late Silurian and the Devonian to accumulate a great thickness of sediments known as the Old Red Sandstone (ORS).

This area then became flooded by sea at the beginning of the Carboniferous period, although it appears that immediately to the N the land remained dry. The shallow, relatively clear sea, rich in marine life, led to the formation of limestones. Later sediments built up over the limestones as deltas and these in turn were followed by swampy rivers, flood plains and lagoons carrying a rich vegetation. During this period the land surface rose and fell many times leading to the deposition of a repeated sequence of sands, muds and coals which formed the Upper Carboniferous Coal Measures.

The Clee Hills occupy high ground [Titterstone Clee 533m (1749 ft OD)], unusual for Coal Measures sediments since these are not particularly strong or resistant to weathering and erosion. Their preservation here has been due to the intrusion at the end of the Carboniferous of a thick layer [sill] of molten rock, locally known as the Dhu stone, which cooled and crystallised to form a very strong igneous rock called dolerite. Fig. 5 shows diagrammatically the way in which sills are formed.

The upland areas of Clee Hill and Titterstone Clee Hill survived the most recent glaciation and their Carboniferous rocks have been preserved as an outlier surrounded by much older rocks. To the W was a meeting point of glaciers: from the N through Church Stretton; W through the Clun valley and S from the Wye valley. These glaciers had a major impact on the landscape and drainage patterns of rivers in the region.

The effects of a wide variety of geological processes and the resulting rocks formed can be seen over quite small distances along the walks.

From the Middle Ages deposits of coal, clay, ironstone, limestone and building and roadstone have been extensively worked and these industrial activities have also left their mark on the landscape. Attention is drawn to these in this Walking Guide

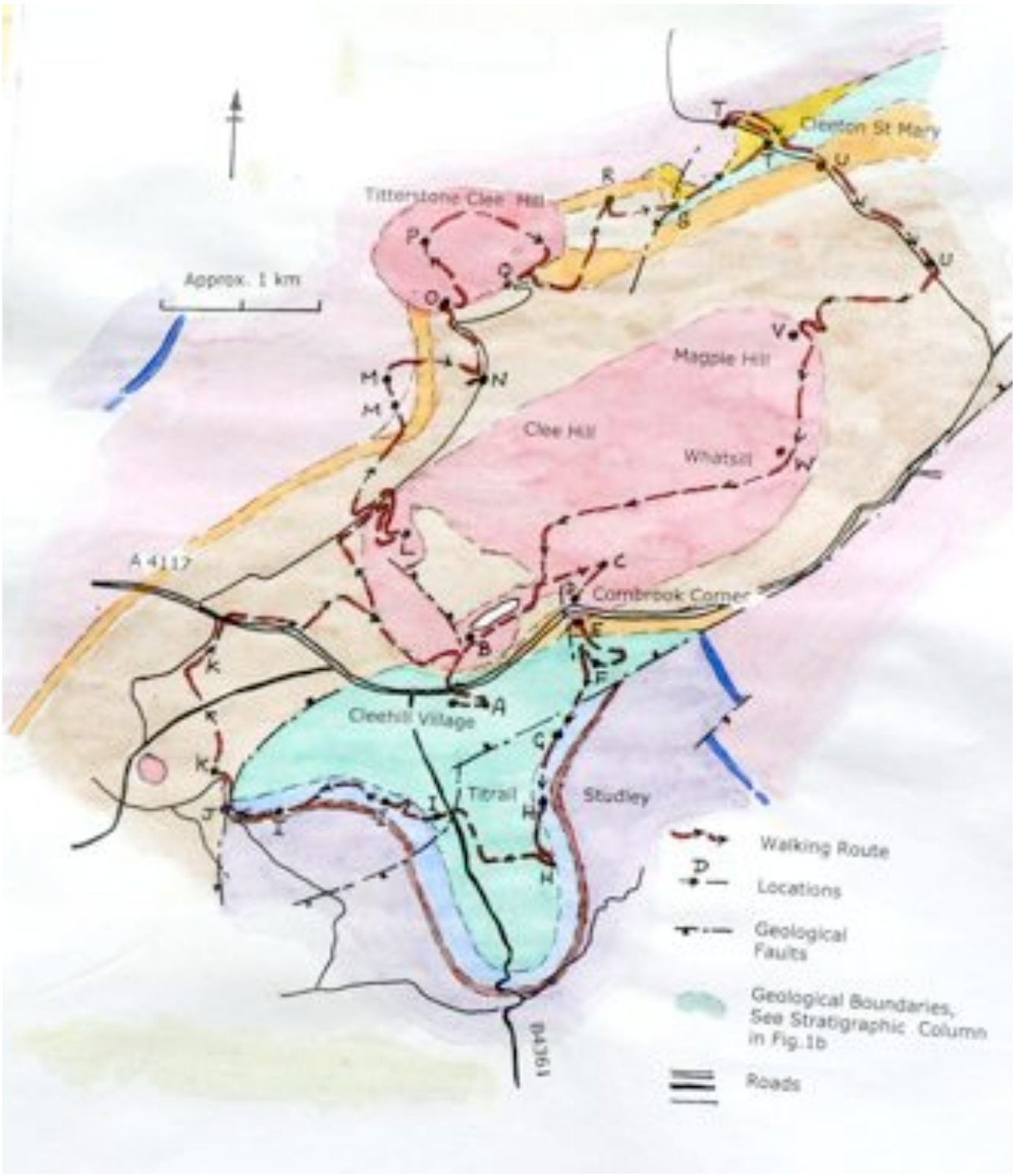

Fig.1a Walking Route and Geological Sketch Map

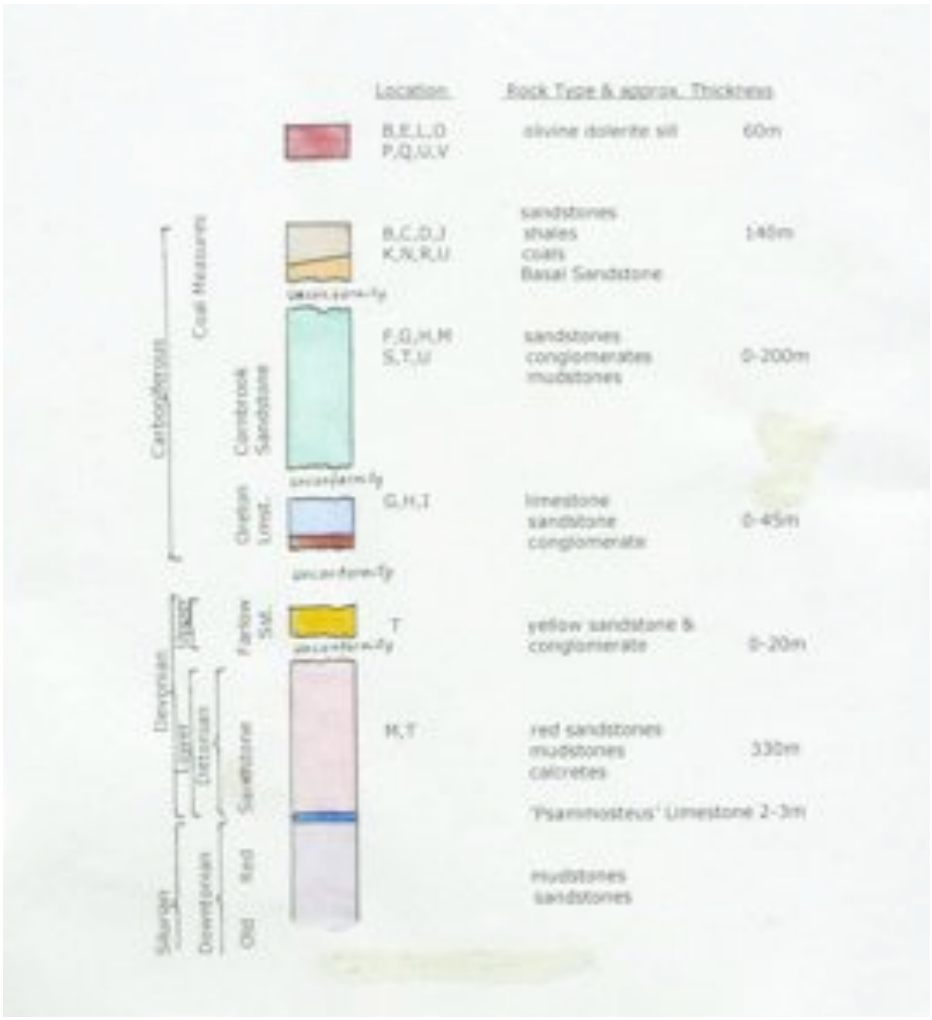

Fig.1b Stratigraphic Column

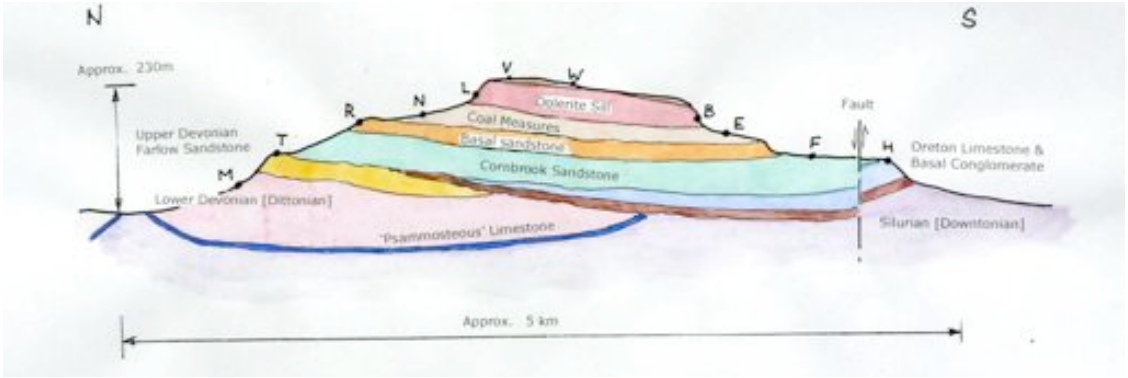

Fig.2 Sketched N to S Geological Section through Clee Hill

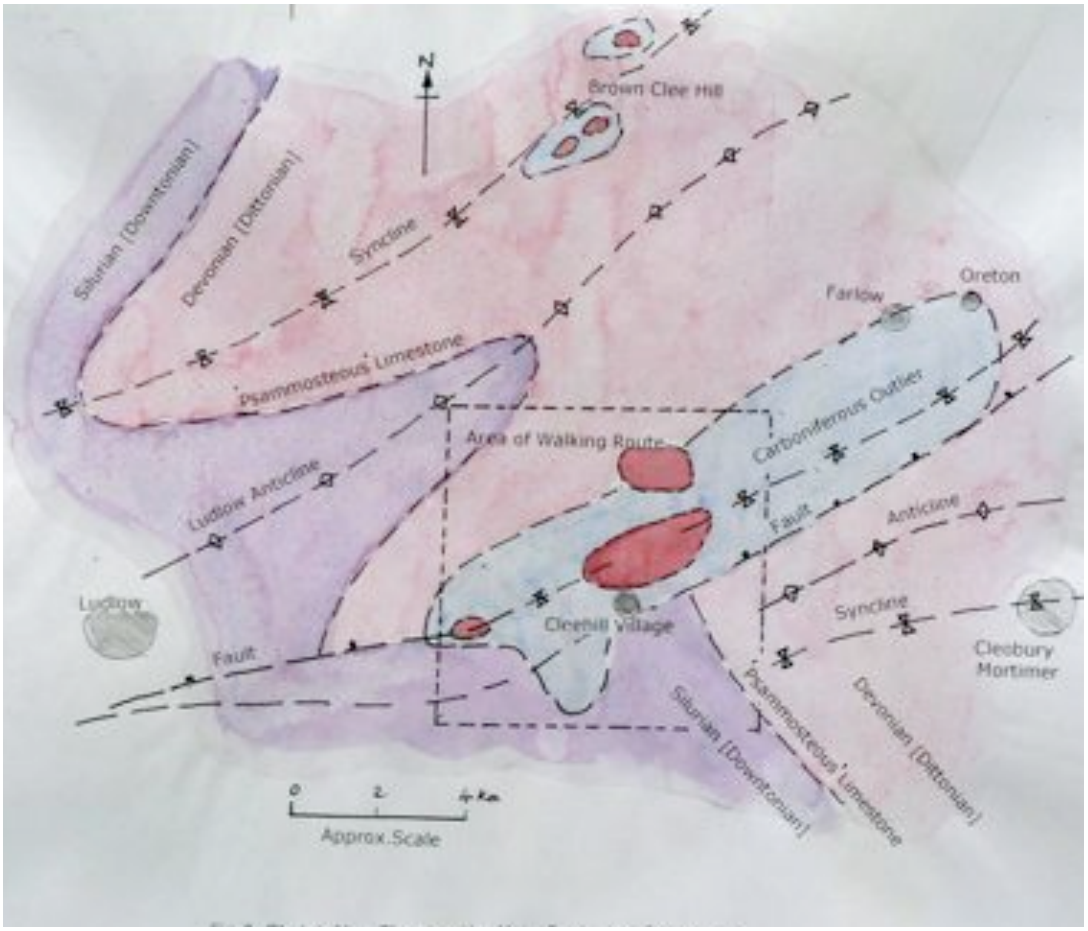

Fig.3 Geological Structure in relation to the Area of the Walking Route

Fig.4 Impression of the Old Red Sandstone [Devonian] Continent lying to the S of the Equator

The Walking Guide

DAY 1

Location A: Display Board [595 753]

The Route starts in Cleehill village at the display board [595 753] in the main car park near the summit of the A4117. [There are local facilities - a Post Office, store, bakery, pubs, public toilets in the village]. 100m to the E of the car park is a viewing platform [toposcope] [5964 7536] that identifies nearby towns and landscape features. The platform is mounted on a concrete plinth which is the cap to an old mine shaft. The Malvern Hills, seen to the S, are formed of some of the oldest rocks in England and Wales [Pre-Cambrian (about 600 Ma)]. Silurian rocks can be seen to the W around Ludlow and also to the SE where they form the Abberley Hills, having been brought to the surface by faulting and folding. Old Red Sandstone rocks [Devonian/Upper Silurian (about 400-360 Ma)] are present in the Teme valley and on the lower flanks of the Clee Hills. The red soil in the fields indicates their presence. Cleehill village is built on younger Carboniferous rocks [about 360-300 Ma].

The Route returns to the car park.

Location B: Incline Quarry[596 757]

From the car park the Route crosses the A4117 and takes the lane towards, and 100 m past, the Kremlin public house to a gate on the right leading to an observation point for the Incline Quarry [5955 7565]. Here the high face exposes an igneous intrusion of the late Carboniferous. This formed when molten rock [magma] forced its way from depth towards the surface then split open the Carboniferous sandstones and shales to spread laterally as a thick layer [sill] [Fig.5].

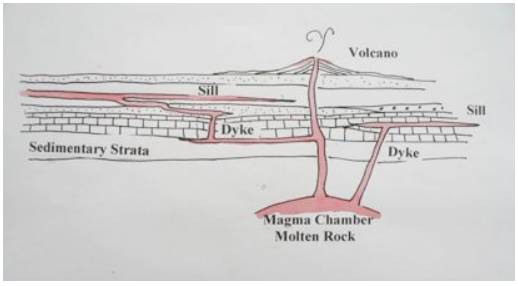

Fig.5 Sketch showing conditions leading to the formation of sills

Its columnar structure is the result of contraction during cooling [Fig.6].

Fig.6 Incline Quarry. The columnar structure in the dolerite due to cooling of the molten rock is clearly seen.

The rock, because of its mineral composition, is called an olivine dolerite [its local name is Dhu stone]. It is bluish grey when freshly broken but brown when weathered [Fig.7].

Fig.7 Blocks of dolerite [Dhu Stone]. The rock is brown when weathered and blue-grey when freshly broken.

In this quarry the sill is overlain by about 4 m of Coal Measures sandstone and mudstone which have been baked hard due to the intense heat from the intruding magma [contact metamorphism] [Fig.8].

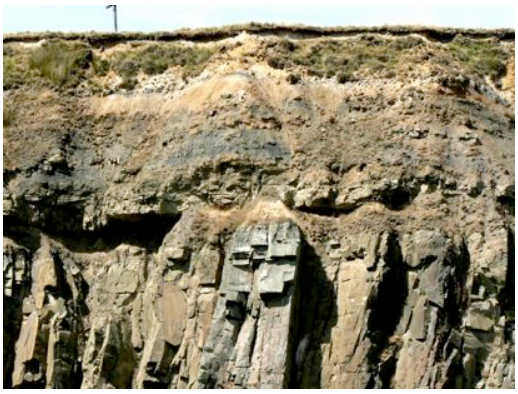

Fig.8. Incline Quarry. Contact between the dolerite sill [vertical structure] and the Coal Measures sandstones and dark grey shales [horizontal structure] can be clearly seen.

ACCESS TO THE CONTACT ZONE IS DIFFICULT AND DANGEROUS HERE - DO NOT ATTEMPT TO CLIMB THE GRASSY BANK TO THE W.

Beneath the sill, below the bed of the shallow lake in the floor of the quarry, there are Coal Measures strata but these cannot now be seen.

Quarrying began on a large scale in the late 1850s, principally for the production of paving setts but also to provide stone for the construction of Cardiff Docks.

Location C: Spoil Heap [599 759]

The Route follows the track alongside the lake, turns left at its junction with the road, continues left for 150m and then right at 5993 7588 on to the common passing the white cottage. It heads E for about 200 m to a prominent spoil heap. The pit's shaft has been capped**.**
BEWARE! DON'T STAND ON THE CONCRETE CAP!

This was typical of the late 19th and early 20th century workings on Clee Hill mining Upper Carboniferous coals [Fig.9]

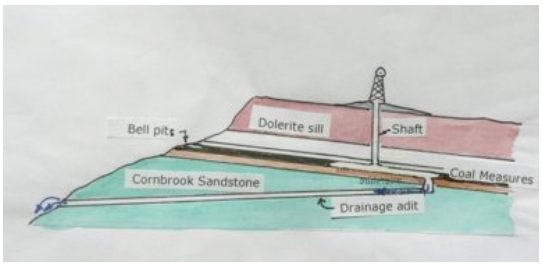

Fig.9 Coal Mining in the 20th century was through deep shafts which were sunk through the hard dolerite sill to reach the productive coal seams. Shallow mediaeval mining was by bell pits [Fig.12].

The coals occur within a sequence of shales and sandstones dating from about 310 to 290 Ma. These were formed in swampy conditions on top of a large delta by the compression of plants and trees [some as tall as 30 m] growing in the tropical swamps [Fig.10].

Fig.10 A Carboniferous swamp scene 300million years ago. [Image courtesy Shropshire County Museum Service]

At that time this area was close to the Equator. There are four principal coal seams ranging in thickness from 2 to 6ft [0.6 to 1.8m]. Fragments of coal and shale, along with traces of plant remains, can be found in the spoil [Fig.11].

Fig.11. Fossil Coal Measure plants [top left clockwise] Horse tail [Annularia], Club Moss [Lepidodendron], Seed Fern [Pecopteris], Horsetail [Calamites].[Photograph courtesy Shropshire County Museum Service]

Coal mining on Clee Hill goes back as far as the 13th century. Extraction before the 18th century was from shallow bell pits [Fig.12].

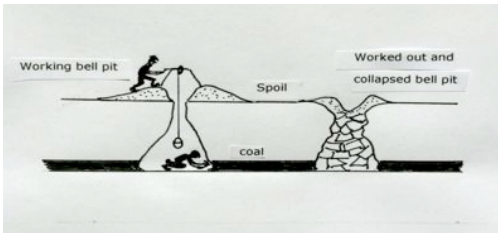

Fig.12 Working and Collapsed Bell Pits

In 1760 deep shafts began to be used, here having to cut down through about 60m of the hard dolerite sill and other layers, before reaching the coal. They were last worked in the 1920s.

Location D: Cornbrook Corner [602 759]

Retrace the Route for about 200m towards the white house taking the track to Cornbrook Corner [6017 7593]. The landscape is bleak. Periglacial processes, described below, operated here during the last glacial period. The hummocky ground is characteristic of such areas due to frost heave and ice-mound growth. Large blocks of dolerite could easily be transported on the mud paste created during the brief summer thaw as groundwater melted and the wet slurry moved downhill over the frozen ground beneath.

Location E: Cornbrook Corner [602 759]

At Cornbrook Corner [6017 7593] there is a low-lying outcrop of Coal Measures to the N and W of the road. The ground is uneven due to small spoil heaps where the coal has been mined. The gorse-covered dolerite sill forms a prominent feature behind this. To the E the Coal Measures are absent and the dolerite sill can be seen across the stream. It also appears in the foundation of the road bridge. There is a fault running along the line of the stream, causing the sill and Coal Measures strata to be moved downwards to the E [Fig.1].

Location F: Cornbrook Dingle [603 756]

The walk crosses the road bridge on the A4117 and the road and follows a downhill track to the S and E of the Cornbrook for about 200m. If the bracken is high follow a steep downhill track to the SSE to a metalled road turning right and continuing on to Cornbrook Dingle and crossing the stream [6030 7558]. Sandstone outcrops can be seen on the E and W banks of the Dingle and can be accessed by a small upstream deviation from the track [Fig.13].

Fig.13 Cornbrook Dingle. Cornbrook Sandstone outcrops upstream on both banks.

Well-developed, iron-stained joints are visible. If the stream section is followed a little further, parallel marks [slickensides] on some fracture surfaces indicate the last direction of movement along these surfaces. The outcrops are part of a thick sequence of rocks known as the Cornbrook Sandstone Formation and are comprised of conglomerate, grit and sandstone. Because these strata contain few fossils there is some doubt about their age. They are probably younger than the Millstone Grit in the lower part of the sequence [about 310 Ma], even though they are similar in appearance to the Millstone Grit outcrop in northern England and equate to the younger Coal Measures [about 300 Ma] in the upper part.

There is a drainage adit on the E bank some 80m upstream of the Dingle that is discharging iron-stained water. This is draining from the abandoned coal mines under the hill above [Fig.9]. The bright colour arises from the oxidation of iron pyrites, a common mineral in Coal Measures strata, and from the bacteria which thrive in the warm, iron-rich acidic water [Fig.14].

Fig.14 Cornbrook Dingle discharge from a mine water drainage adit [see Fig.9].The orange colour comes from the oxidation of iron pyrites in the Coal Measures.

The rough ground on the valley floor is the detritus of a former iron foundry whose power came from a water mill mounted to the E of the Dingle. The concrete channel for the mill leat can still be seen [Fig.15].

Fig.15. Cornbrook Dingle old mill leat

The ore for the foundry came from ironstone concretions occurring in Coal Measures mudstone.

Location G: Studley [601 747]

The walk continues to the SW, climbing out of the Dingle and then following a downward sloping path which may be the bed of an early [19th century] mineral tramway, possibly transporting iron ore and coal to Studley for smelting.

There are many sandstone and conglomerate boulders in walls and lying on/adjacent to the path.

In the valley to the left of the track there is a long low bridge [Fig.16]. This bridge carries large diameter water supply pipes which extend from the Elan Valley Reservoirs in Wales to Birmingham. The pipes run into tunnels to the west and the tunnel spoil can be seen as a smooth green mound at the base of the hill.

Fig.16 Elan Aquaduct pipe bridge near Studley.

On the hillside to the W of the track there is a series of large hummocks running at mid-slope for about 1 km. These are old limestone quarry workings and mark the line of an exposure of Carboniferous Limestone [known locally as the Oreton Limestone] lying below the Cornbrook Sandstone [Fig.1].

Location H: Studley [601 747]

At Studley [6005 7470] the track comes to a small stream. In the bankside there is a small exposure of conglomerate and sandstone [6007 7471] [Fig.17] and many large blocks of these lying in the stream bed. The conglomerate contains sub-angular to rounded pebbles of quartz, quartzite and occasional red jasper. This is the Basal Conglomerate of the Carboniferous and lies below the [Carboniferous] limestone and above Old Red Sandstone strata [at this location, late Silurian]. At the break in slope, which marks the Carboniferous/Silurian junction, there is a 60 million year time gap. This is an unconformity - all the Devonian rocks are missing [Fig.2].

Fig.17 Studley outcrop of Basal Carboniferous Conglomerate lying below the Oreton Limestone

Above the conglomerate the route climbs steeply up the bank and into a limestone quarry. Small pieces of limestone are easy to find but there is very little exposed rock. However one small exposure [6004 7841] reveals a flaggy limestone. Fragments of fossil shells and crinoids may be seen [Fig.18].

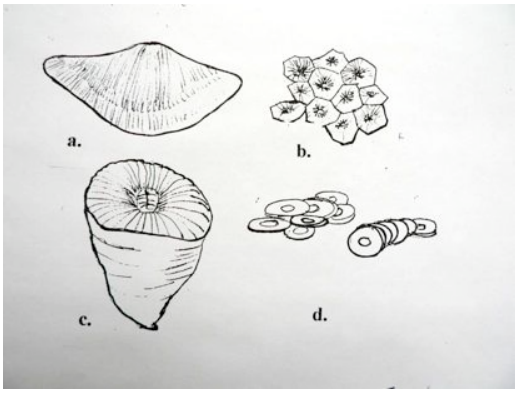

Fig.18. Lower Carboniferous fossils: a) Shells; b) Multiple Coral; c) Single coral; d) Crinoid 'stalks'.

This limestone [Oreton Limestone] is Tournaisian [about 350 Ma]. It was formed in a shallow, relatively clear sea and contains many fossil fragments. At the time this area was located close to the Equator but since then has progressed northwards to its present position due to movement of the tectonic plates. The limestone appears to have been formed on the southern margins of a land mass stretching E-W. Oreton Limestone has features more in common with the very much thicker Carboniferous Limestone to the S [e.g. Bristol, Mendips], than to the N [e.g. Derbyshire, North Pennines].

This was an important source of limestone in South Shropshire. It was quarried extensively over most of its outcrop and used to prepare lime for building mortar, as a soil improver and as a flux for local iron smelting. Generally quarrying ceased as the face became high, making it uneconomical to remove the overlying strata. However in some places [e.g. Knowle Wood on the S edge of the limestone outcrop] the limestone workings were extended by tunnelling underground.

The route returns to the track and crosses the stream. It turns left [S] uphill onto a partly metalled road and past Studley Villa. The old limestone workings lie to the left of the road and the Cornbrook Sandstone to the right. There are many pieces of limestone, sandstone and conglomerate along the verges.
The route continues along the road crossing over the Cornbrook Sandstone. At a bend [6004 7438] an exposure of the sandstone can be seen 50m down a crossing track to the S.
The route continues on the road uphill, turning right before a cattle grid [5977 7431] on to an uphill track to the NW. After about 300m there is a flat area of ground with many pieces of limestone and sandstone containing iron rich veins [Fig.19] from higher Coal Measure rocks. This suggests that iron may have been smelted near here. The route turns left over another cattle grid [5960 7462] and continues to the main road at Titrail.

Fig.19 Pieces of sandstone with iron rich veins and fragments of Oreton Limestone on the ground near Titrail.

Location I: Titrail [595 746]

At Titrail [595 746] the Trail crosses the road and takes the western footpath leading to Gorstley Rough. There is a line of old quarry workings within the Oreton Limestone to the right of the path. This is the same limestone that occurs at Location H. Good exposures of flaggy limestone [Fig.20] can be seen to the N of the track at about 40m up a short track under trees [5925 7464].

Fig.20 Oreton Limestone exposed along Gorstley Rough.

Fossil fragments can be found in the limestone [Fig.18]. There are a two small lime kilns [Fig.21], partly hidden by hawthorne, [5916 7467] along the track adjacent to the wood.

Fig.21. Small limekiln along Gorstley Rough

The route follows the line of the limestone workings through woodland for about 800m along a footpath to the W. On emerging from the woodland the route crosses a stile and a field and continues in the field at the boundary with a wood. It continues along the edge of the woodland where the Basal Conglomerate can be seen below the Oreton Limestone [5839

7453]. The limestone and conglomerate form a distinctive feature but it is not possible here to see the contact [at the break of slope] with the underlying Old Red Sandstone [Upper Silurian] [Figs.1&3]. *Just beyond this exposure, enter the woodland through a small gate on the right. The route then progresses into the wood, following the workings until reaching the metalled road [582 746] by the two pubs at Bennetts End.*

Location J: Bennetts End [582 747]

At Bennetts End the Trail proceeds N along the road. The limestone workings of Location I appear to have stopped abruptly. There are exposures of black Coal Measures shale to be seen in the stream of the Colly Brook [5815 7465] where the Oreton Limestone would be expected to outcrop. A fault runs along the valley floor here, dropping the Coal Measures down to the E and bringing them into contact with the older Oreton Limestone [Fig.1].

Location K: Collybrook Park [580 748]

At the sharp left-hand bend in the road the Trail turns right into Collybrook Park estate then follows the footpath which runs due N for 200m along the stream. This road used to be the track bed for an incline railway, enabling coal, iron and bricks to be taken from the Knowbury Brick & Tile Works [on the site of the Collybrook housing estate] to a loading platform on the Caynham road.

In the stream bed, 50m from the gate, to the E of the track [5807 7503] there is a good exposure of Coal Measures sandstone, a pale grey seat earth and traces of coal [Fig.22]. Seat earth clays, because of their purity, were often used to manufacture fire bricks or refractory pots. However, it is necessary to cross over a small patch of private land to reach the stream bank. It is recommended that permission be sought from the owner living in the house at the top of the track on the right.

Fig.22 Coal Measure seat earth with traces of coal exposed in the bank of Colly Brook.

The route continues N 100m along the footpath, turns E at 5805 7510 climbs a grassy bank and then, after a further 200m, turns N at 5822 7512 to reach Caynham Road at 5797 7524. From here the route crosses Caynham Rd and follows the footpath NNE for 400m. Coal shales and fragments of coal can be seen in the bank sides. At a minor road the route turns right and continues to the A4117. The ground to the left includes The Winthills, [Fig.23] where permission was sought, but refused, for open cast coal extraction in the 1990s. The hummocky ground is due to mediaeval bell pit workings.

Fig.23. Winthills with Titterstone Clee Hill on the skyline.

At the end of **Day 1** turn right and follow the A4117 back to Cleehill or to avoid the traffic after 500m on the A4117 turn left up a track and follow the public footpaths back to Cleehill past the Kremlin Public House.

DAY 2

From the car park in Cleehill the route crosses the A4117 and takes the lane to the Kremlin pub, then the footpath leading from a farm gate W from the pub car park. This track passes some cottages then goes downhill to a T junction where the route turns to the right and continues for about 1km to the W to the Titterstone Clee access road at 5876 7626. To the right of the track the dolerite sill forms a distinct feature; to the left the hummocky ground is the result of old coal workings.

Location L: Dhu Stone Quarry[590 762]

The route continues NE to the cattle grid at 5904 7651, then turns right [SE] along the quarry access track by the side of the drainage ditch.
From this point the route crosses the concrete slab of the drainage ditch, goes over the stile and up the steps to the skyline and the top viewing area at 590 762. Here the active Dhu stone quarry can be seen [Fig.24]. The use of quarry waste to re-landscape the area is described in detail on the information board [5918 7635].

The Coal Measures can be seen overlying the dolerite sill to the left of the main access road to the quarry. A fault lies along this main access road lifting the sill up to the right [Fig.24]. The sill shows an extensive weathered profile to the S of the fault.

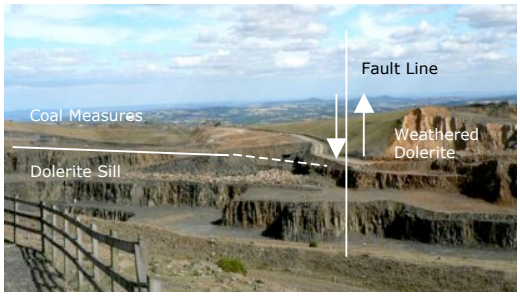

Fig.24 Working Dhu Stone [dolerite] Quarry; weathered dolerite on the right is faulted against Coal Measure Strata overlaying dolerite on the left.

The route returns down the steps to the lower viewing area display board [5901 7635]. From here the asymmetrical Ludlow anticline [up-folded strata] can be seen [Fig.25].

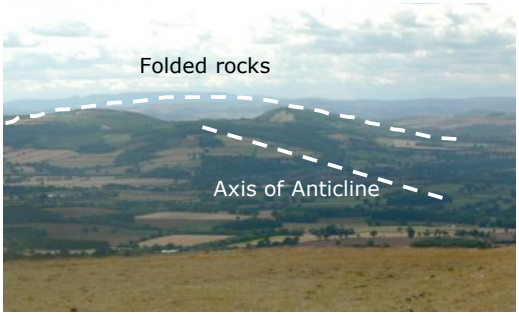

Fig.25 The Ludlow anticline outlined by the Mortimer Forest where the Silurian Limestones have resisted erosion.

This folded sequence of strata extends NE and passes between Titterstone Clee and Brown Clee [Fig.3]. The Upper Silurian limestones are more resistant to erosion than the mudstones and form the high ground of Mortimer Forest to the S of Ludlow.

At Location L the sill lies within the Coal Measures, but to the N, below the summit of Titterstone Clee [Fig.26], it appears to intrude into the Old Red Sandstone.

Fig.26 Titterstone Clee Hill. The dolerite sill appears to overlie the Devonian rocks.

On Brown Clee to the N the sill is found just within the Coal Measures. It is possible that the sill once extended as a continuous sheet between the Clee Hills and has since been eroded away [Fig.3], however there may have been two separate intrusions.

Location M: Benson's Brook [591 772]

The route returns to the Summit Road by the cattle grid [5904 7651]. It then turns left back down the Summit Road for about 150m to a stile on the right next to the gateway to Nine Springs Farm at 5890 7636. It then turns right [NE] along this track [part of the Shropshire Way] towards and through Nine Springs Farm [5911 7705] and N into the valley of Benson's Brook, passing to the L of a black barn at the farm and following the hedge line down to the Brook. Stone barn walls adjacent to the farm contain a wide selection of local stone [Fig.27].

Fig. 27 Barn wall at Nine Springs Farm contains a wide range of rock types, including iron rich veins in some of the sandstones.

This part of Benson's Brook [5906 7721] shows a series of good exposures of Devonian sediments of Lower Dittonian age [about 370 Ma], particularly upstream of the footbridge, where easterly dipping sandstones and mudstones occur in the brook's sides and bed [Fig.28]. Within the predominantly red mudstones green reduction spots, indicating former organic activity, can be seen. Detailed study of the sediments has shown that they were derived from mountains to the NW.

Fig.28 Dittonian sandstones and red and green mudstones in Benson's Brook near the foot bridge

The land further upstream is private, preventing access. However previous surveys show the Cornbrook Sandstone [Location F] overlying the Old Red Sandstone. There is no Oreton Limestone here. This is an unconformity.

The route continues along the Shropshire Way for 100m uphill. It turns right at a metalled track [5900 7723] and continues E and uphill to rejoin the Summit Road at Horseditch [5953 7734].

Location N: Horseditch [596 773]

Alongside Horseditch [596 773], just downstream of the road, there is an outcrop of Coal Measures. These

consist mainly of thick sandstones and sandstones with conglomerates, occasional traces of coal and grey mudstones with ironstone nodules [Fig.29] [5950 7728].

Fig.29 Coal Measure strata at the top of Benson's Brook near Horseditch

Spoil heaps from mediaeval bell pits [Figs 30 & 12] on either side of the road may also yield fragments of these rock types. This area of bell pits is a Scheduled Ancient Monument. Orange staining of sediment in the stream bed indicates oxidation of iron pyrites, a common constituent of Coal Measures strata [see Location F].

Fig.30 Bell Pit spoil at Horseditch.

Location O: Titterstone Hill Quarry [594 776]

The Trail returns to the road and proceeds N over the Coal Measures and uphill towards Titterstone Hill Quarry [5935 7755]. The quarry is a prominent excavation in the dolerite sill, which has a similar composition here to the sill exposed at Locations B and L, but it is separated from them by Coal Measures strata [Fig.1]. The remains of the quarry plant can be seen, as can the embankment for the incline railway running downhill to the SW [built in 1880].

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 [Fig.31]. 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.

Fig.31Titterstone Quarry [Field & Mackay,1911].

Location P: Titterstone Clee Hill summit [592 780]

The route follows the Shropshire Way NW to the summit of Titterstone Clee Hill [592 780] where the walls of an Iron Age fort can be seen amongst an extensive field of frost- shattered boulders.

Glaciations have taken place a number of times during the last 2 to 2.5 Ma. 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 W of the Clee Hills was the meeting point of three major glaciers. The summits of the Clee Hills remained free of ice but experienced permafrost conditions. The large boulders of dolerite covering the summit and its flanks show extensive frost shattering and many were transported downhill [see location D] to form the broad apron of debris below, now partly obscured by bracken [Fig.32].

Fig.32 Titterstone Clee Hill looking N and showing blocks of dolerite at the bottom of the slope resulting from frost action during the last glaciation. The red soil in the distant fields results from the weathering of the Old Red Sandstone bedrock.

Local rivers were also affected by glaciation.The River Teme, which today flows E to the Severn, formerly flowed W, then S into the Wye. This change in direction was brought about by glacial ice which dammed the river valley, forming temporary glacial lakes which then overflowed and eroded new channels to the E.

The route leads E down from the summit past the radar stations to join the road leading downhill to the Radar Quarry [597 777].

Location Q: Radar Quarry [597 777]

The Radar Quarry [597 777] 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 [Fig.33].

Fig.33. In the Radar Quarry relatively recent rock collapse along the vertical cooling joints in the dolerite sill can be seen. The Weather Radar Dome in the photograph was the first in the network of operational weather radars installed in the UK. It is used in measuring and predicting precipitation over a radius of about 90km.

Location R: The Basal Sandstone [603 783]

The route leaves the Radar Quarry [597 777] and returns up the metalled road for about 200m to a sharp bend [599 777]. The edge of the Clee Hill dolerite sill presents a clear feature along the skyline to the SW. Coal Measures lie in the valley between the two sills. *The route leaves the road, continuing downhill following the line of electricity poles for about 400m to meet a faint grassy track [6006 7785].* There are many blocks of frost-shattered dolerite underfoot [see Location P].

The Route follows this grassy track for about 200m then forks left [6014 7800] towards a field gate. It passes through a field gate at 6022 7817 and continues past a ruined building, due N

for 150m to another field gate , before arriving at the top of a steep ridge. This is formed by the Basal Sandstone of the Coal Measures which can be seen in the steep face of the ridge at 6029 7831 [Fig.34]. The exposure shows thick beds [about 15m] of quartzitic sandstone and conglomerate, dipping SE at about 40 degrees. They form a strong NE-trending feature running down towards Shirley Brook.

[a]

[b]

Fig.34 Coal Measure Basal Sandstone [a] *in situ* [b] conglomerate boulders at the base

The Route then returns to the track, following it E and taking a right fork just before a power line, towards Shirley Brook. It crosses an area of moorland with many bell pits [Fig.12], where shallow coals lie above the Basal Sandstone.

Location S: Shirley Brook [607 783]

Where the track crosses the brook [6068 7829] there are many sandstone, dolerite and conglomerate boulders. The spoil from the bell pits can be seen flanking the W bank both up and downstream at this point but there are no bell pits in equivalent positions on the E bank, implying that coal-bearing strata are absent to the E at this point. This indicates a fault along the line of the brook with a downthrow to the W [Fig.1]. Shirley Brook thus appears to be a fault-guided stream.

The route continues to follow the track, climbing E out of the valley on to moorland. It continues towards the church at Cleeton St Mary. The ridge of Basal Sandstone examined at Location R can be seen to the W and this runs down towards Shirley Brook. It appears that the Upper Carboniferous strata here are overstepping the Upper Devonian, a 60 million year gap in deposition [an unconformity]. Unfortunately the contact cannot be seen directly in Shirley Brook. It is interesting to note that here, to the N of the Clee Hill outlier, the Carboniferous rocks lie unconformably on Devonian strata whereas to the S [Locations H and I] they rest on Silurian rocks [Fig.1].

Location T: Cleeton St Mary [611 787]

At Cleeton St Mary the route takes the road to the N of the church, heading W. The hamlet is located on a bluff of fine and coarse yellow sandstone and conglomerate known as the Farlow Sandstone, which is Upper Devonian in age [about 380-360 Ma]. It is best exposed 3 to 4km to the E between Farlow, Oreton and Preston where some 20m of fine and coarse- grained grey and yellow sandstone and

massive yellow and green quartz conglomerate are found. At Cleeton St Mary there are only small exposures in the steep bank to the S of the road [6095 7874].

There is a distinct line of wet ground across and down the bluff and this probably marks the junction between the Farlow Sandstone and the underlying marl of Dittonian age [Lower Devonian]. This marl can be seen by proceeding into the valley of the brook where, just above the bridge [609 785], in the stream bed there are exposures of blocky red mudstone with green reduction zones [Fig.35] [see Location M].

Fig.35 Dittonian Red and Green Mudstones in the bed of Shirlley Brook at Cleeton St Mary

Middle Devonian rocks are missing here. There are other exposures of Farlow Sandstone and the Dittonian marl and mudstone at some distance upstream in the bed and sides of the brook **BUT THE WALKING HERE IS VERY DIFFICULT**.

The route returns E up the road to the church [6017 7865]. This is built mainly of yellow Farlow Sandstone which does not weather well. The window and door quoins were therefore constructed from the stronger reddish Felton Sandstone which was quarried from the Downtonian [Silurian] just N of Ludlow. Current bedding can be seen in many of these blocks [Fig.36].

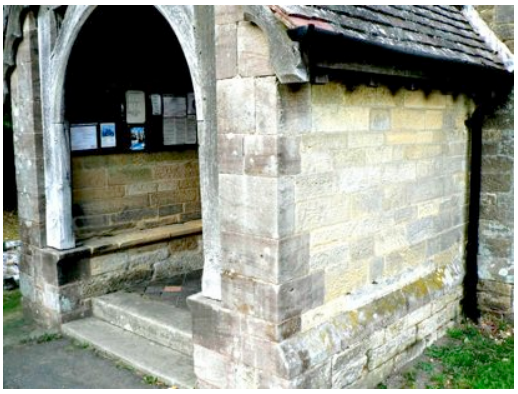

Fig.36 Yellow Farlow Sandstone in the wall of the porch of the church of Cleeton St Mary. The corner stones are of more resistant red-brown Felton Stone

Opposite the church gate to the E there is a wall of sandstone and conglomerate blocks. Many of these are reddish in colour and are probably Cornbrook Sandstone, an outcrop of which lies just to the N of the church.

Location U: Craven Cottage [622 779]

The route proceeds SE along the road towards Craven Cottage. 400m from Cleeton, at a rise in the road, there are many boulders of sandstone with layers of white quartzite pebbles [Fig.37] and more coloured conglomerates in the bank sides and walls [6131 7855].

Fig.37 Boulders of quartzite conglomerate and a grey sandstone from the Basal Sandstone [see Fig.34b.]

This location is close to the boundary [Fig.1] between the Cornbrook Sandstone and the Coal Measures

Basal Sandstone and material from both formations can be found. Very large blocks of the Coal Measures Basal Sandstone [see Location R] can be seen by taking a short detour at this point, either to the NW or the SE on the crossing track.

The route continues to the SE along the road where soil in the bank to the S becomes progressively blacker, reflecting the presence of the underlying Coal Measures. *After about 1km [624 778] the route takes a track to the right towards Magpie Hill.* There are many old coal mine workings to be seen along the track.

Location V: Magpie Quarry [614 778]

On reaching the quarry track at 6140 7775 the route enters the old Magpie Quarry workings and proceeds S. The olivine dolerite sill exposed here is the same as that encountered at Locations B and L. From 1909 to 1928 the rock was transported by aerial rope-way E to a transfer station at Detton Ford on the Cleobury Mortimer & Ditton Priors Light Railway. The foundations of the aerial rope-way towers and other works can still be seen clearly. **SOME OF THE STRUCTURES ARE IN A DANGEROUS CONDITION AND NONE SHOULD BE ENTERED.**

Fig.38. Aerial ropeway to carry dolerite from Magpie Quarry.

Access to the top surface of the sill is possible in some places. The face is steep and if a close examination of the contact with the thin overlying Coal Measures is to be made **GREAT CARE SHOULD BE TAKEN**. In some places baked black Coal Measures shale can be seen close to the sill top [6132 7725] [Fig.37]. In other places the sill is deeply weathered.

Location W: Whatsill [615 760]

The route follows the quarry road S towards Whatsill [6145 7680] where many large coal mining spoil heaps are visible to the N of the road. Reaching the coal, which lay below the dolerite, involved sinking deep shafts [up to 60m] through this hard rock [see Location C]. The last coal mining was in the 1920s.

The route then follows a well-defined track from Whatsill to the W for about 1.6km towards the working quarry [600 764], then turns down the quarry road to the Incline Quarry [Location B] and from there back to Cleehill village.

Maps and References

For those wishing to consider the geology of Titterstone Clee Hill and Clee Hill in more detail reference may be made to:

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These Walks have been prepared by Gill & Brian Wilkinson and Michael Rosenbaum. They are based on a more extensive detailed geological guide document developed by Mike Rosenbaum and Brian Wilkinson for the Shropshire Geological Society. This is available on the Society's website [www.shropshiregeology.org.uk] and contains a fuller bibliography on the geology of the Clee Hills.

Disclaimer - The information contained in this Walking Guide has been prepared following several walks along the routes, a summary of the geological literature of the area and visits to all the locations described. Its sole aim is to give visitors to the area some pleasant walking and an insight into its geology and the links between and past and present industry. It should not be used for any other purpose.

Cleobury Mortimer Footpath Association Parish Walk September 2006
Titterstone Clee ahead on the skyline