Carboniferous Limestone, Triassic and Jurassic rocks of the Mendip Hills.
Stump Cross area, Shepton Mallet, Somerset
Date: 27 February 2026 Branch: Wessex Leader: Stephen Thompson

Mendip Hills: geological history

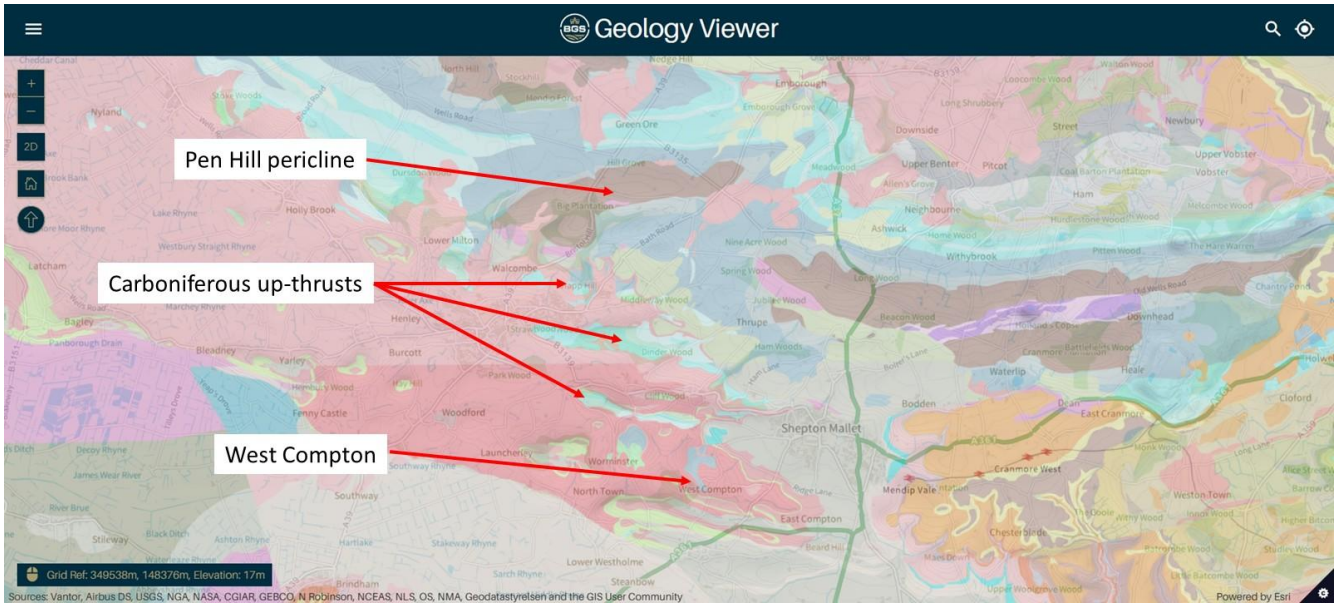
Palaeozoic

Formed during the Variscan Orogeny, the Mendips were perhaps up to 4,000 ft high. At large scale, there are 4 en-echehlon periclines: Black Down, North Hill, Pen Hill and Beacon Hill. This structure was produced by wrenching or twisting during the folding. In the core of the anticlinal structures are Silurian andesites (425Ma), overlain by Devonian sandstones of the Portishead Formation. This "Old Red Sandstone" represents a desert environment with flash floods producing sandstones and conglomerates. There is then a series of Carboniferous deposits (not all present in all places), from old to young:

- Avon Group
- Black Rock Limestone (so called because of the organic material it contains. New exposures can smell of petrol, though no useful oil has been extracted.)
- Burrington Oolite
- Clifton Down Limestone
- Oxwich Head (or Hotwells) Limestone
- Coal Measures

These were all folded and faulted in the Variscan. There is then an angular unconformity, and later Triassic and Jurassic sediments were deposited on the sides of the Mendips High.

In West Compton we were just to the south of Paradise Hill which is capped by Carboniferous limestones. This in one of several thrust-faulted blocks pushed up during the orogeny. These faults produce outcrops of the Carboniferous south of the main pericline, clearly visible on a geological map. For explanation of the structure, see Williams and Chapman, 1986 (e.g. Fig 4).



Mesozoic

The orogeny also threw up very high mountains in the Massif Central and Brittany: these drained northwards as far as the Solway Firth (Marsh et al, 2022), shedding sediments in a Ganges-sized braided river. This river (the Budleighensis) flowed, from late Permian to early Triassic times, through several basins which it filled over time: proximal ones (e.g. the South Devon Basin) tend to have larger clasts.

The palaeoenvironment and rivers are described in Ruffell, A., & Hounslow, M. (2006) – see Figs 13.5 and 13.6 especially. See also Newell, 2024, esp Fig 1 which shows the outcrop of the Mercia Mudstone Group.

The Mercia Mudstone Group (formerly known as the Keuper Marl), which is about 480m thick in the Somerset Basin (Newell, 2024), consists of reddish brown, silty to sandy mudstones with minor intercalations of siltstone and sandstone. Evaporite beds indicate that the MMG was an arid environment with occasional flash floods which washed coarser material through the system, leaving water bodies which then evaporated. A hard silica band of unknown origin can be found in several places locally.

The Mercia Mudstone has significant impact on the geomorphology. The sandy parts can be well-cemented, but the muddy parts are very prone to weathering. Rain can penetrate down to 30ft and turn the mudstone to slippery mud. In addition to which, some of the mudstone is a marl (carbonate-rich mud with <50% of clay minerals) and absorbs water more strongly that clays (>50% of clay minerals). The higher water absorption makes the marls expand, further encouraging the mudstone to break up.

Along the southern flanks of the Mendip Hills a conglomerate composed dominantly of dolomitised clasts of Carboniferous Limestone and known as the 'Dolomitic Conglomerate' (DC) occurs in which calcite, $CaCO_3$, has been partly replaced by $MgCO_3$. The Mg may have been sourced from volcanic activity – possibly in the Carboniferous and included in the eroded sediments. The DC was deposited during the late Triassic by high energy streams flowing off the proto-Mendip Hills towards the MMG dominated lowlands. Accordingly, the DC usually grades laterally into the Mercia Mudstone (see section below) but in the Shepton Mallet area there is a suggestion that DC may occur as discrete beds

within the Mercia Mudstone mud and clay horizons (Bristow, C R and Donovan, D T. 2003). Some of it may be polished, and this is known locally as the Draycott Marble.

The dating of the DC is uncertain. Early workers equated it to fissure deposits in the Mendip which were dated as Rhaetic from reptile fossils but more recently many geologists consider it to be variable in age and older as show in section from Tucker and Sparks 2024 – below.

Tucker M & Sparks R S J 2024
Fluvial-lacustrine interactions in the Marginal Triassic, Clevedon, Bristol Channel Basin, UK: deposition, dolomitization and silicification Geological Magazine November 2024 Vol 1

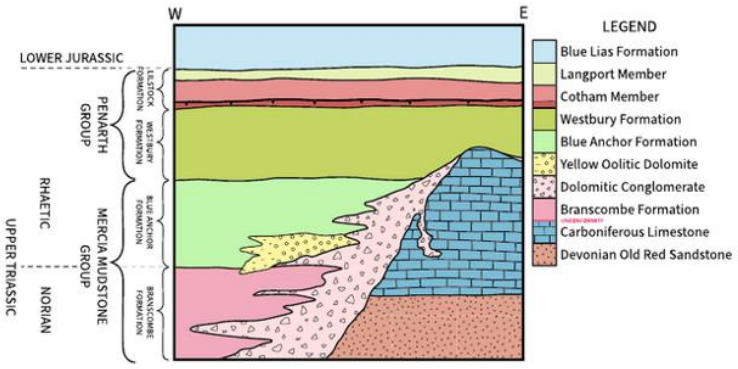


Figure 3. Schematic cross-section of the Bristol Channel Basin margin in the late Triassic-early Jurassic, with strata onlapping an Upper Palaeozoic topography. The yellow oolitic dolomites are the subject of this paper.

This was followed by the marine transgression at the end of the Triassic, represented by the Blue Anchor Formation of the MMG and the succeeding Penarth Group.

The transgression occurred in three phases: the first got about 1/3 of the way up the Mendips and at these times, the Mendips would have been a series of islands in the Jurassic sea. The second got 2/3 of the way up, and the last phase covered the hills completely.

At the start of the Cretaceous, the Mendips may have re-emerged but were covered again in the late-Cretaceous sea level maximum. Remnants of the Upper Greensand have been found, and it is believed that chalk once covered the Mendips (flint has been found, and chalk in a fissure): see Farrant et al, 2014. Following the Palaeogene re-emergence, the present land surface was probably buried to a depth of perhaps 1.5km.

Geomorphology

Looking across the valley from the front of Stephen's house the skyline is topped by the Penarth Group (latest Triassic). In front of it is a secondary skyline also capped by the Penarth Group which may be detached by faulting. The slopes leading up to the skylines are MMG and have slumped extensively taking power lines and buildings downslope.

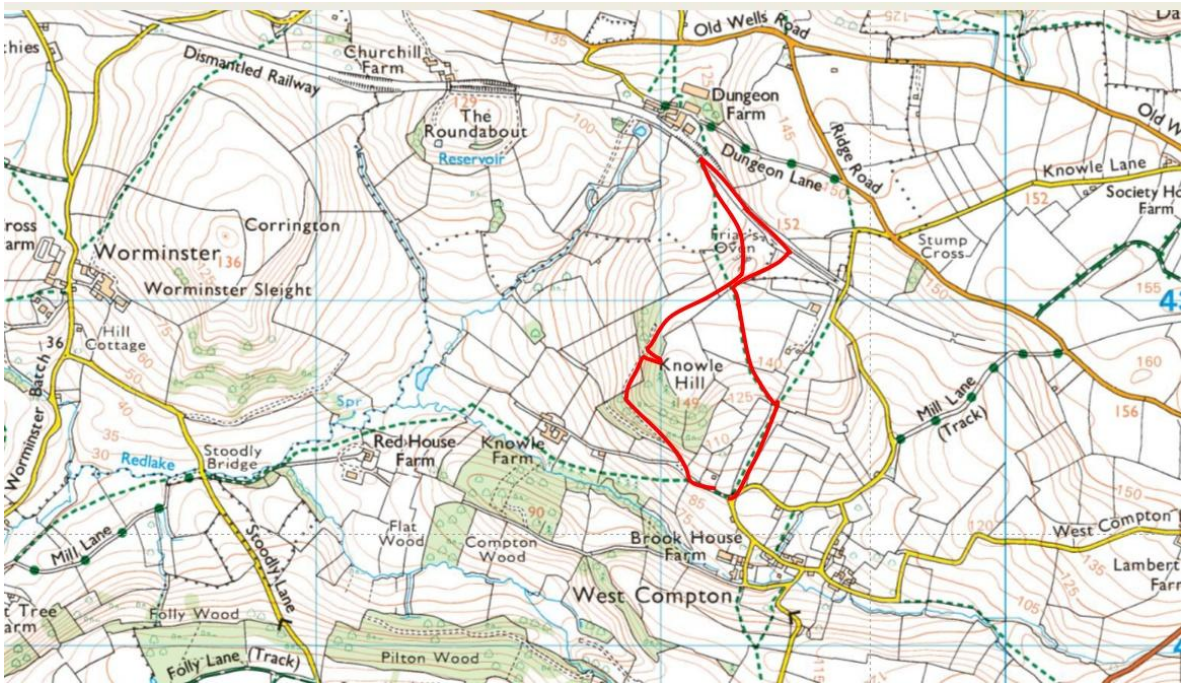
In the floor of the valley is a stream whose course contains two waterfalls over a harder part of the MMG. Immediately upstream of each fall the stream course bends through 90°: because the section in between the bends has moved along a fault. Stephen has traced many small faults crossing the stream path. The stream is called Redlake, "red" because it drains the MMG. To the south of the hill,

a second stream flowing through Pilton drains the Jurassic Blue Lias and Charmouth Mudstone: it thus has uncoloured water and is called Whitelake. “Lake” derives from a Saxon word for river or stream.

From the top of Friar’s Oven behind Stephen’s house is a view (facing south east) down the Redlake valley towards Glastonbury and the Somerset Levels (whose flooding was clearly visible). The valley sides are a classic U-shape, with Worminster Sleight (sleight – a sheep grazing area) on the right and Stoodly Hill on the left. On the far skyline in the distance are the Blackdown Hills, and in front of them the Polden Hills. The Quantocks are probably just out of view behind Worminster Sleight.

The valley was, presumably, formed peri-glacially in the Quaternary when large rivers removed ice melt. To the north of us is a hill called the Roundabout which may have been formed by swirling waters in the same era.

The walk



Gate. The gate at the end of Stephen's drive has posts of Doulting Stone. These came from a former chapel. The Doulting quarry was owned by the abbot of Glastonbury: the abbot of Wells owned Croscombe Quarry just to the north of us, which extracted Chilcote Stone from the lower Jurassic Beds. In times when the two abbots were at loggerheads, Doulting Stone was unavailable at Wells.

Lane. Walking west along the lane, a wall was on our right hand. Part of this was the remains of a building, with facings on both sides. Some of the stones contained barite crystals: there is a band of barite about 15" thick just under the road surface. Before the modern road was built, this lane was the main road between Shepton Mallet and Glastonbury.

Field gate. A field gate had posts of dolomitic conglomerate. These are widely used and found over an area wider than the outcrop.

Quarry. Towards the top of Knowle Hill a quarry face (kindly cleared by Stephen a few days earlier) shows Carboniferous Black Rock Limestone with a fissure infilled with red Triassic sediments. The Limestone is fractured near the fissure sides, making it easier to extract.

Friar's Oven. This excellent viewpoint was less use to us today as the clouds rolled over and we had 5 minutes of rain. It is an SSSI for its flora (fungi, orchids) and also has a cliff face in the Black Rock Limestone. This feature of an exhumed landscape was probably – at one point during the Jurassic transgression – a cliff on a coast.

From this high point we could see across to the former Dulcote Quarry now occupied by a food preparation factory. The quarry is in the Clifton Down Limestone. "Dulcote potatoes" are rounded rocks which when split open have crystals inside.

At the foot of the cliff a loose collection of stones turned up crinoids and corals.

Railway cutting. The walls of the cutting intersect a fault such that walking from east to west you get
Branscombe Mudstone Formation (part of the Mercia Mudstone Group)
Blue Anchor Formation (top of the MMG)
White Lias Formation (part of the Penarth Group)
Back to the Branscombe Mudstone Formation

The BAF and WLF are exposed as relatively thin climbing bands underlain by the Black Rock Limestone: this is fractured by a series of conjugate faults which formed roughly perpendicularly to the north-directed thrusting of the Variscan orogeny. The faulting also created voids later filled with calcite.
The contact between the White Lias and the Branscombe Mudstone is a significant unconformity.

Calcite in fault void

Conjugate fault in cutting wall

Recent rain has caused a slump in the MMG part of the cutting wall which has fallen away and blocked the cutting completely. The unconformity with the White Lias is on the left of the picture below.

Field. On our return journey, we walked down the side of a field through which Stepen had helped dig a trench to lay a water pipe. This provided during the work a section through part of the MMG which revealed four thin bands of harder sandstone within the mudstone sequence. These were

conveniently marked by trees in the nearby hedge and are interpreted as having been deposited by flash floods.

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