Rocks of Mendip

Sedimentary rocks

With the exception of a small area of Silurian volcanic rocks, the Mendips are made up of sedimentary rocks ranging in age from Devonian to Jurassic. Sedimentary rocks are formed by the accumulation of debris, such as sand and mud or the remains of organisms such as shells, in a range of different environments. Over time sediments are buried and harden into rock, a process known as diagenesis, thus forming sandstone, mudstone or limestone, depending on the original sediment.

Sediments are usually deposited in a series of layers or beds, which may vary in thickness and character and contain features that are diagnostic of certain environments, such as ripple marks. A sequence of beds that forms a mappable unit of rock is known as a ‘formation’ and is given a name, for example the Charmouth Mudstone Formation. A series of successive formations that show broadly similar characteristic are known collectively as a ‘group’, or ‘subgroup’ and also given a name, for example the Avon Group.

The Mendips are characterised by a wide variety of sedimentary rock types formed in a range of different settings from tropical seas, to coal swamps and arid deserts. This section outlines the geological history and describes the major rock units that can be seen as you explore the area.

The story of the Mendips

Volcanoes and sandy plains

The story of the Mendip Hills begins some 444 to 416 million years ago, during the Silurian Period. The region that was destined to become the Mendips lay under a shallow sea. About 425 million years ago, an explosive volcano erupted into this sea, depositing a suite of volcanic rocks, now exposed in the Beacon Hill area.

By the Devonian (416–359 million years ago), the sea had receded and much of Britain was part of a large landmass. During the latter part of the Devonian, about 360 million years ago, the Mendip region lay on a coastal plain on the southern edge of this landmass. Rivers draining mountains to the north deposited a thick sequence of sediments across the area, and these are preserved as the Portishead Formation. To the south, sea covered the area that is now Devon and marine sediments accumulated there.

Tropical seas, corals and limestone

At the start of the Carboniferous about 359 million years ago, Britain lay close to the Equator and conditions would have been warm. Shallow tropical seas and lagoons covered the area, but as the sea level rose, muddy carbonate and silt accumulated — this is the Avon Group, but was formerly known as the Lower Limestone Shale. As the sediment supply diminished and the seas cleared, carbonate deposition dominated and the Carboniferous Limestone was formed. Many fossils can be found in the limestone, including corals, fossil sea shells (bivalves and brachiopods), crinoids (a fossil sea lily), and trilobites. The Carboniferous Limestone can be divided up into four major limestone units, each with a distinctive character and suite of fossils.

River deltas, muddy swamps and fossil forests

During the late Carboniferous (327–299 million years ago), limestone deposition was curtailed by a massive influx of land-derived sediment deposited on a large river delta, part of a series of deltas advancing from the north. Sand and mud that accumulated on these deltas is preserved as the Quartzitic Sandstone and the Coal Measures. Large areas of swampy tropical forest developed on the delta tops, and the remains have been preserved as thin coal seams that contain exquisitely preserved fossil plants and insects in places. Some of these coals were worked in the Somerset

Coalfield.

Mountains, rocky ravines and arid deserts

Towards the end of the Carboniferous a major period of uplift and mountain building occurred. The Devonian and Carboniferous rocks were folded into a series of four asymmetric periclines (a pericline is a type of anticline which plunges at each end, resembling an upturned boat). These periclines are centered on Blackdown, North Hill, Pen Hill and Beacon Hill. The rocks were also faulted, with older strata thrust up over younger strata, creating a series of thrust 'slices'. This folding and faulting created a range of steep rugged mountains. During the Triassic (251–200 million years ago) the climate was hot and dry. Occasional storms incised many deep steep-sided ravines or wadis into the flanks of the mountains. The mountain flanks and valleys were buried by material eroded from the mountains which was subsequently cemented by calcite to form the Dolomitic Conglomerate. These slope deposits thin rapidly away from the Mendips, grading into red mudstone, the Mercia Mudstone Group, which was deposited in the surrounding lowlands. At the end of the Triassic, the sea began to encroach into the area once again, and the youngest Triassic beds are coastal and shallow marine in origin.

Rising seas and the Mendip archipelago

At the start of the Jurassic (200–145 million years ago), the marine transgression continued, at times submerging almost the entire area and leaving only a few areas of land to create the 'Mendip archipelago'. Limestone accumulated in a series of shallow lagoons, together with beach (littoral) deposits of the Lower Jurassic Lias Group. Much thicker sequences of Jurassic sediments accumulated in the deeper water that

lay to the south. Eventually sea level rose to submerge the entire area, depositing hundreds of metres of Middle and Upper Jurassic and also the Cretaceous strata that are seen to the east of Frome. Only during the Quaternary, following uplift and extensive erosion, have the Mendip Hills re-emerged from their deep burial to give the present 'exhumed' topography we see today.

Rock types seen in the eastern Mendips

Silurian rocks

There are three types of Silurian rocks: andesite lava, tuff and agglomerate, which originated as volcanic ash and ejecta. Sedimentary rocks were deposited in the sea surrounding the volcanic island. These are mostly grey mudstones with fossil brachiopods. The rocks are best seen in Moon's Hill Quarry, near Stoke St Michael.

Devonian rocks

This is part of the 'Old Red Sandstone', which consists of reddish brown sandstone and conglomerate (pebble beds). The sandstones were deposited in an arid, desert-type environment by seasonal rivers. Rare fish remains have been found in some places. The Portishead Formation outcrops in the core of four periclines: Blackdown, North Hill, Pen Hill and Beacon Hill.

Carboniferous rocks

Avon Group (Lower Limestone Shale)

This sequence of interbedded mudstones and thin fossiliferous limestones marks the transgression of the sea at the start of the Carboniferous. Some of the thin limestone beds are crowded with fragments of crinoids and other fossils that indicate a marine setting. They used to be well exposed in an old railway cutting near Maesbury.

Black Rock Limestone Subgroup

This a very dark grey, fine-grained fossiliferous limestone. It contains many broken fragments of crinoids (sea lilies) and brachiopods. Black chert nodules are common, as are silicified *Spirifer* brachiopods. The Black Rock Limestone is particularly well exposed in Vallis Vale.

Burrington Oolite Subgroup

This rock is a light grey oolitic limestone. The rock is composed of many small spherical grains of carbonate known as ooliths. They formed by the deposition of carbonate in concentric layers around a nucleus, rather like a pearl. Oolites form today in warm, supersaturated, shallow, highly agitated marine water, often in areas with strong tidal currents. In eastern Mendip, the Burrington Oolite is locally replaced by the Vallis Limestone Formation, a crinoid-rich oolitic limestone.

Clifton Down Limestone Formation

The Clifton Down Limestone consists of dark-grey and black fine-grained muddy limestone, with some oolitic limestone beds. Chert nodules are common and *Lithostrotion* corals and large *Productus* brachiopods have been found. The Clifton Down Limestone is well exposed in Fairy Cave Quarry.

Oxwich Head Limestone Formation

The Oxwich Head Limestone is the youngest part of the Carboniferous Limestone sequence. It consists of grey bioclastic limestone with much crinoid debris and some chert nodules, interbedded with oolitic limestone.

Quartzitic Sandstone and Coal Measures

Overlying the Carboniferous Limestone is a sequence of coarse, red sandstones and grey mudstones. These mark a change from open marine to terrestrial conditions. The sandstones were deposited as a river delta built out into the sea. The Coal Measures consists mainly of dark grey mudstones, commonly containing plant remains, and some coarser red sandstone beds. Interbedded within these mudstones are thin coal seams, which have been worked in the North Somerset Coalfield.

Triassic rocks

Dolomitic Conglomerate

This rock is actually a breccia, a coarse grained, poorly sorted mixture of boulders and angular fragments of Carboniferous limestone and, less commonly, sandstone bound together with finer grained sediment. It outcrops along the flanks of the Mendips and has been used as a building stone.

Mercia Mudstone Group

In addition to red mudstone, this group contains siltstones and sandstones. The mudstones were deposited as wind-blown dust in a desert, with periodic development of ephemeral lakes, and washed in by flash floods from rain storms. On the flanks of the Mendips, the mudstones either interfinger with the Dolomitic Conglomerate or overlie it. The top of the Mercia Mudstone is a green mudstone known as the Blue Anchor Formation.

Penarth Group

The Penarth Group rests on the Mercia Mudstone, and includes dark blue mudstone (the Westbury Formation), and pale fine-grained limestone (the Langport Member or ‘White Lias’). It marks the transgression of the Jurassic sea over the Triassic desert landscape, reflecting the early stages of submergence of the land surface. The sediments were deposited in shallow marine, lagoonal and near-shore environments.

Jurassic rocks

The Lias Group

The Lias Group, as it appears over most of southern England, is made up of several formations. The oldest is the Blue Lias Formation (shown on the map with the Langport Member) which comprises an alternating succession of thin, hard limestone and dark mudstone beds. The overlying Charmouth Mudstone is a dark grey fossiliferous mudstone. Both contain ammonites and bivalves. Around Doulting the Bridport Sand and Beacon Limestone formations are not well exposed.

Downside and Chilcote Stone (Lias Group)

Around Shepton Mallet, the Blue Lias and Charmouth Mudstone are replaced entirely by conglomeratic limestone. This rock formed near an ancient shoreline — the Mendips at this time formed part of a string of islands that extended westwards into south Wales. The limestone contains beds of broken and thick-shelled bivalves, and pebbles of Carboniferous limestone.

Inferior Oolite Group (Doulting Stone)

The Inferior Oolite is a golden yellow, fossiliferous limestone made up of ooliths. The rocks are richly fossiliferous with brachiopods, bivalves, ammonites and echinoids. This formation was quarried for building stone at Doulting.

Great Oolite Group

The youngest Jurassic rocks are the Fuller’s Earth Formation and the overlying Frome Clay, Forest Marble and Cornbrash formations, all part of the Great Oolite Group. These are mostly mudstones and bioclastic limestones.

Figures

(Figure 1) Contact the mendip hills image

(Figure 2) Geological timescale.

(Figure 3) The Soufrière Hills Volcano, Montserrat.

(Figure 4) Block diagram of a pericline.

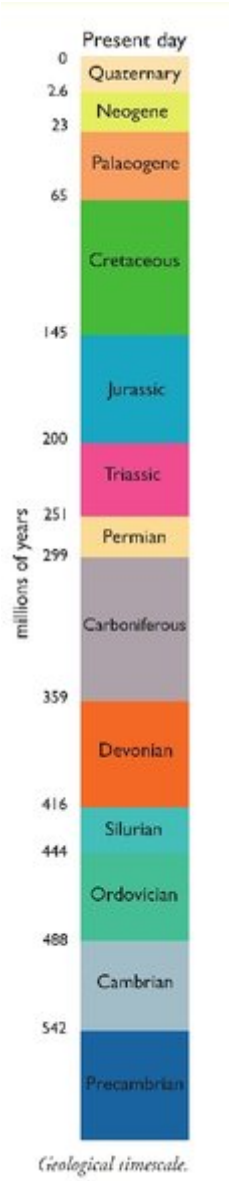
(Figure 5) Diagram of a thrust fault.

(Figure 6) Portishead Formation (Old Red Sandstone), Avon Group (Lower Limestone Shale), Black Rock Limestone Subgroup,Burrington Oolite Subgroup.

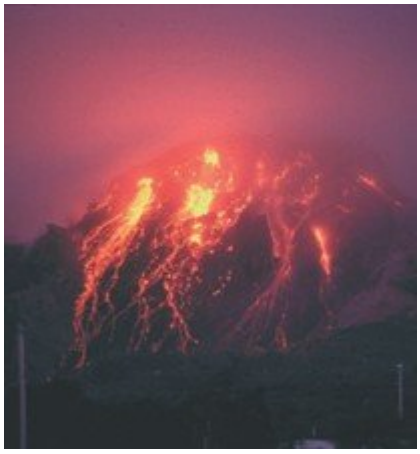
(Figure 7) Clifton Down Limestone Formation; Oxwich Head Limestone Formation; Quartzitic Sandstone and Coal Measures; Dolomitic Conglomerate; Mercia Mudstone Group.

(Figure 8) Penarth Group Langport Member/Westbury Formation; The Lias Group; Chilcote Stone; Inferior Oolite Group (Doulting Stone).

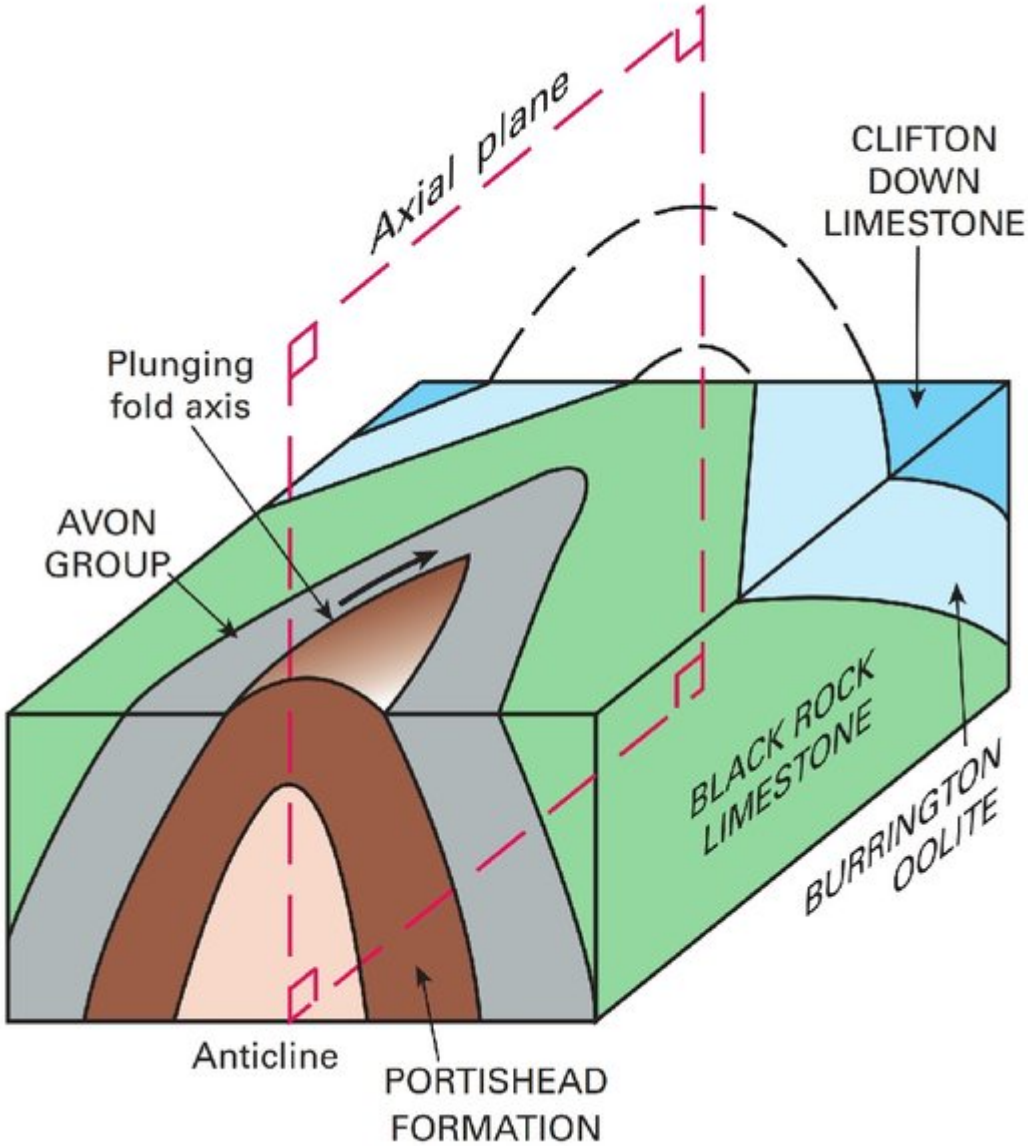
(Figure 1) Contact the Mendip hills image.



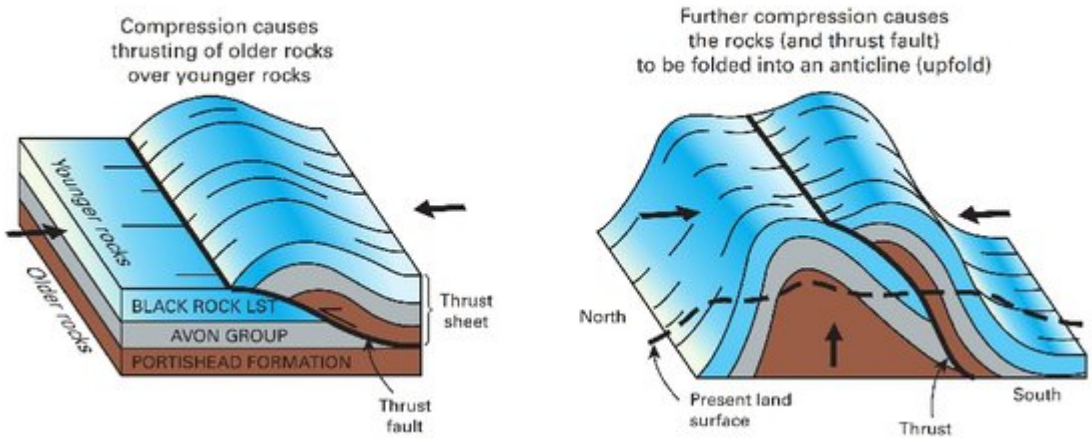
(Figure 2) Geological timescale.



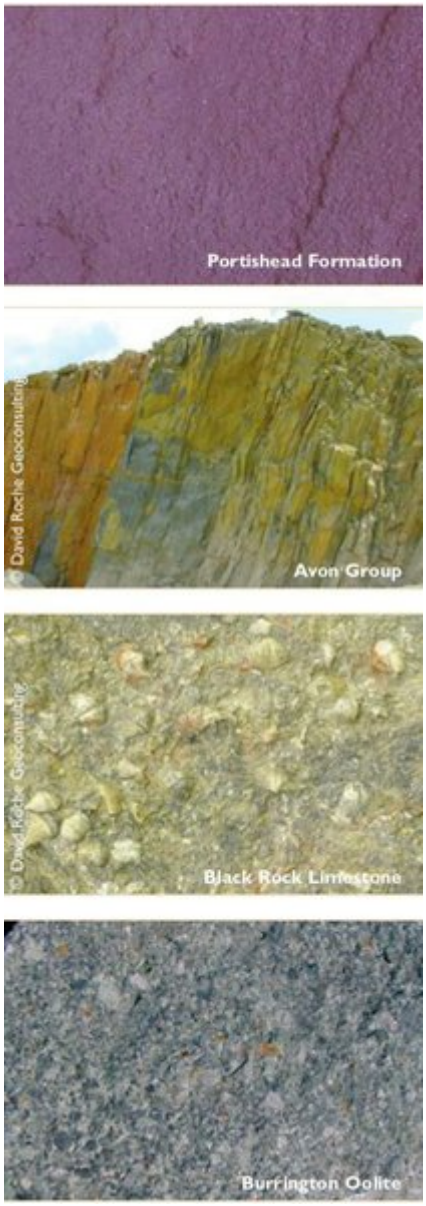
(Figure 3) The Soufrière Hills Volcano, Montserrat.



(Figure 4) Block diagram of a pericline.

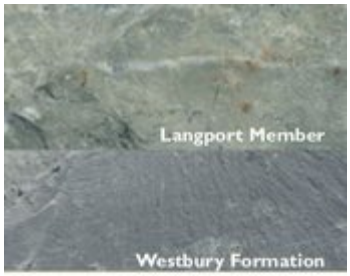


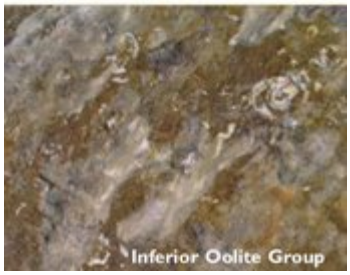
(Figure 5) Diagram of a thrust fault.



(Figure 6) Portishead Formation (Old Red Sandstone), Avon Group (Lower Limestone Shale), Black Rock Limestone Subgroup,Burrington Oolite Subgroup.

(Figure 7) Clifton Down Limestone Formation; Oxwich Head Limestone Formation; Quartzitic Sandstone and Coal Measures; Dolomitic Conglomerate; Mercia Mudstone Group.





(Figure 8) Penarth Group Langport Member/Westbury Formation; The Lias Group; Chilcote Stone; Inferior Oolite Group (Doulting Stone).