

Bristol and Gloucester region - an introduction

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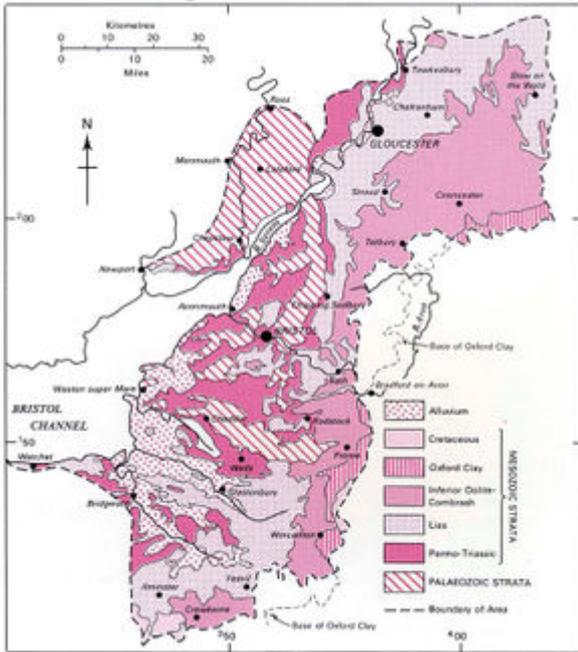
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Green, G W. 1992. British regional geology: Bristol and Gloucester region (Third edition). (London: HMSO for the British Geological Survey.)

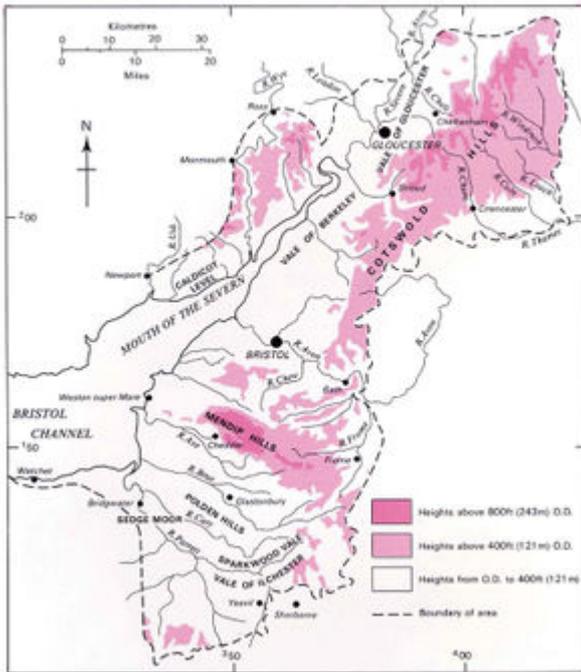
Introduction

Chronostratigraphical (time) units System	Series	Lithostratigraphical (rock) units	Age (10 ⁶ years)
Quaternary	Holocene	Alluvium, peat, terrace deposits, raised-beach deposits, marine sands, head deposits, cave deposits, glacial deposits	10 000
	Pleistocene	~~~~~	about 2
Cretaceous		Chalk	130
		Upper Greensand	
		Gault	
Jurassic	Upper Jurassic	Oxford Clay and Kellaways Beds	205
	Middle Jurassic	Great Oolite Group	
		Inferior Oolite Group	
	Lower Jurassic	Upper Lias	
		Middle Lias	
		Lower Lias	
Triassic		Penarth Group	250
		Mercia Mudstone Group	
		Sherwood Sandstone Group	
?Permian		Bridgnorth Sandstone (Midlands) unnamed sandstones (South-west) ~~~~~	290
Carboniferous	?Stephanian		365
	Carboniferous	Coal Measures	
	Westphalian		
	Namurian	Quartzitic Sandstone Group	
	Dinantian	Carboniferous Limestone	
Devonian	Upper Devonian	Upper Old Red Sandstone	400
	Lower Devonian	~~~~~ Lower Old Red Sandstone	
Silurian	Pridoli	Thornbury Beds Downton Castle Sandstone	418
	Ludlow	Whitcliffe Beds, Leintwardine Beds, Bringewood Beds, Elton Beds	
	Wenlock	Brinkmarsh Beds	
	Upper Llandovery	Toetworth Beds Damey Beds	
		~~~~~	
Cambrian	Tremadoc	Micklewood Beds	>475
		Breadstone Shales	

Main stratigraphical subdivisions present at outcrop in the Bristol-Gloucester region (not to scale). The ages shown refer to the worldwide system limits and only correspond to the base of the rock units where the local succession is complete. (P948992)



Sketch map of the geology of the region. (P948956)



Sketch map of the physical features of the region. (P948957)



Cheddar Gorge. (P209670)



Dry valleys floored by permeable limestones.  
a. Jurassic limestones in the Cotswold Hills.  
(P210757)



Dry valleys floored by permeable limestones.  
b. Carboniferous Limestone, Burrington  
Combe, Mendip Hills. (P006945)



The Wye valley, looking northwards from Symond's Yat to the Old Red Sandstone ridge of Coppet Hill. (P206191)



The Avon Gorge. (P006701)



The Horse-shoe Bend of the Wye from the Wyndcliff. (P206207)



The south face of the Mendips seen across the alluvial flats of the Somerset Levels.

(P206222)

The area dealt with in this book comprises the Cotswolds and the Severn Estuary region, and includes the greater part of the counties of Avon, Gloucestershire and Somerset (excluding west Somerset); also, for geological continuity, small parts of the counties of Gwent, Herefordshire, Worcestershire, Wiltshire and Dorset.

Geologically speaking, it is one of the most varied districts of Britain, for, with the exception of the Ordovician and possibly the Permian, there is exposed at the surface every geological system from the Cambrian to the Cretaceous ([P948992](#)).

The geological map ([P948956](#)) shows that the central part of the region is occupied by a triangular area of Palaeozoic rocks (concealed in many places by a thin covering of Mesozoic strata) extending from the Forest of Dean to the Mendips. To the south and north-east of this Palaeozoic triangle lie unbroken stretches of Mesozoic sedimentary rocks.

## Physiography

The distribution of high and low ground ([P948957](#)) is related both to the nature of the underlying rocks and to the denudation to which they have been subjected. In general, the Palaeozoic rocks, by reason of their relative hardness, give rise to areas of moderately high relief. In parts of south Gloucestershire and Avon, however, the outcrops of the Cambrian, Silurian, Old Red Sandstone and Carboniferous beds are characterised by low undulating country. This apparent anomaly is due to the removal by erosion of the Mesozoic cover from these older strata, revealing part of an ancient erosion surface which had been reduced to very low relief before it was covered by sediments in Mesozoic times.

In the south-west and south of Bristol, Palaeozoic rocks form areas of moderate relief lying between 100 and 200 m above sea level. These comprise the Long Ashton to Clevedon ridge, which is separated by the Flax Bourton valley from the dome-like mass of Broadfield Down, with Dundry Hill, formed of Mesozoic rocks, on the north-east. This mass is limited to the south and east by the valleys of the Yeo and Chew rivers. Apart from the inlier of Cannington Park, near Bridgwater, the most southerly outcrop of Palaeozoic rocks in the district forms the elevated, undulating plateau of the Mendips, which extends from Frome on the east to Brean Down on the west, and continues out to sea in the rocky islands of Flat Holm and Steep Holm. Three hill ridges in the western part of the Mendips reach a height of just over 300 m.

In contrast with this, there lies to the south of the Mendips an expanse of alluvial flats ([P206222](#)) concealing extensive depressions scoured out of soft Mesozoic sediments. The dead flat of these moors or 'levels' is broken by the low ridge of the Polden Hills, Brent Knoll and the rising ground above Wedmore.

Running roughly parallel with the eastern margin of the district, comparatively hard Jurassic limestones form the mass of the Cotswolds, whose indented, wall-like scarp, overlooking the Vale of the Severn, runs from Chipping Campden to Bath. On Cleeve Common, near Cheltenham, the Cotswolds reach their maximum height of 330 m. Southwards to Bath the general height of the range gradually decreases, the hills around Bath attaining an altitude of 180 to 240 m. To the south of Bath, the Mesozoic strata form a tract of ground which, though seldom exceeding 175 m in general height, is very varied in relief, being deeply dissected by the River Avon and its tributaries, notably the River Frome and the Cam and Wellow brooks. This region merges into the eastern part of the Mendips, where the Mesozoic rocks form a thin intermittent covering to the Palaeozoic strata.

Between Bath and the Mendips the clay interval between the Jurassic limestones becomes more marked because of the replacement of the Great Oolite by the Frome Clay. Two roughly parallel ridges, separated from one another by low ground, are thus formed. The Inferior Oolite gives rise to the range of hills that runs from Lamyatt Beacon, near Bruton, past Castle Cary and Cadbury Camp, to near Yeovil. A second ridge, formed by the Forest Marble, lies to the east and extends from Wanstrow, past Redlynch, to Bratton. South of this point it comprises the eminences of Charlton Hill and East Hill near Milborne Port and, outside the region, the ridge of Lillington Hill lying to the south-east of Sherborne. Between Yeovil and Crewkerne, the Forest Marble limestone forms the Abbott's Hill and Ashlands Hill ridge, which reaches a height of 182 m.

The drainage of the district is comparatively simple. Practically all rivers west of the Cotswold scarp flow into the Severn Estuary, whereas those which follow the dip slope of the Cotswolds join the Thames ([P948957](#)). The Bristol Avon is an exception. Rising within the eastern margin of the district at Badminton, it flows eastwards as a consequent stream down the dip slope of the Cotswolds for about ten miles to Malmesbury, as if belonging to the Thames drainage system. At Malmesbury it turns south-west and follows the strike of the Jurassic beds to Bradford-on-Avon, whence it flows west and north to Bath, re-entering the district at Limpley Stoke. In its passage to Bath it runs against the dip of the Jurassic rocks and cuts a wide, deep valley. From Bath to Hanham Mills the river flows mainly over Triassic and Lower Jurassic strata, and then cuts a gorge in Coal Measures sandstone from which it emerges at Bristol. Here it turns as if heading for the Low Flax Bourton Valley and the sea at Clevedon, but instead of following this apparently easy route along the outcrop of the soft Triassic rocks it turns north-west at Clifton and enters the famous gorge carved in the hard Carboniferous Limestone ([P006701](#)). Before flowing into the Severn Estuary at Avonmouth it is joined at Sea Mills by the River Trym, which cuts a similar, though smaller gorge through the Carboniferous Limestone ridge near Henbury.

The Avon and its tributaries thus appear to represent superimposed drainage, i.e. their present anomalous courses were initiated not on the rocks and land surface at present exposed, but on a comparatively regular covering of Mesozoic rocks which was subsequently removed by denudation. The course of the River Wye may have been similarly determined during the initial stages of its development.

## Scenery

Tremadocian and Silurian rocks form no special topographical features owing to the limited extent of their outcrop and to the Triassic planation. By contrast, the massive Brownstones and conglomerates of the Old Red Sandstone in Gwent, west of the River Wye, give rise to fine wooded scarps that sweep north-eastwards from Newport through Wentwood to near Trellech. Their soil is poor and thin, and the region is one of small farms with fields bounded by thick stone walls; much of the ground is now devoted to forestry. In the Forest of Dean, the conglomerates form several prominent ridges, such as Edge Hill, Soudley, and Coppet Hill near Symond's Yat ([P2061910](#)). Old Red Sandstone rocks give rise to much of the wooded Failand ridge near Bristol, the sandy tract of Milbury Heath and the featureless moorland summit of Blackdown in the Mendips.

It is in the Carboniferous Limestone districts that some of the most striking scenery is to be found. Although the limestone is hard, it is traversed by strong vertical joints which determine the cliff profiles of deep gorges such as Cheddar Gorge ([P209670](#)) and the Wye Valley ([P206207](#)). These are incised in bare uplands, like the Mendips, where weathered limestone crags project through the thin soil. Owing to the solubility of limestone in waters charged with carbon dioxide, such tracts are usually waterless; streams reaching the limestone plunge underground through 'swallets' or 'slockers' and, running through subterranean passages and caverns glistening with stalactites,

finally emerge in great springs at the foot of the hills. The underground streams and their springs are exemplified by the waters which pour into Eastwater Cavern, to emerge at Wookey Hole, and by those which descend the swallets at Charterhouse and issue at Cheddar.

The same phenomena may be seen, on a very much smaller scale, in some of the oolitic limestone districts, where valleys are dry or are subject to seasonal flow over part of their course ([P210756](#) and [P006945](#)); but here the softness of the limestone precludes the formation of deep gorges.

The scenery of the Coal Measures contrasts strongly with that of the Carboniferous Limestone. Consisting mainly of shale with a thick median division of sandstone known as the Pennant Formation, they give rise, in the Forest of Dean, to thickly wooded undulating ground of moderate relief in which the sandstone forms ridges. The scenery of the Bristol Coalfield is monotonous and, because of the late Triassic planation, it shows little of that differentiation of relief that might have been expected from the occurrence of alternating hard and soft rocks. In the Somerset Coalfield, however, the pre-Triassic surface has been uncovered in a few places only, and over the remainder of the area the Coal Measures are concealed by Mesozoic strata, which impress their individuality upon the scenery.

The predominantly soft nature of the Triassic and Liassic rocks gives rise to areas of low relief, such as the vales of Gloucester and Somerset. The scenery is not, however, without charm; the level country through which the River Severn flows forms miles of rich pasture and orchards, broken occasionally by undulating ridges of harder rock which at Tewkesbury, Westbury and Fretherne make low cliffs. In Somerset the Blue Lias limestones form the Polden Hills and other low ranges of hills separating the fertile plains of red Triassic marl from the heavy clay lands of the Lower Lias.

Southwards from Stroud, the Upper Lias sands crop out in the face of the Cotswold escarpment, and in south and east Somerset give rise to steep sandy slopes and knolls such as those of Glastonbury Tor and Montacute. Deeply sunken lanes or 'holloways' are a characteristic feature of this type of country.

A striking natural feature of the region is the prominent scarp of the Cotswolds, extending from Chipping Campden to Bath, formed by the Inferior and Great Oolite limestones. The former, dominating the escarpment in the north and mid Cotswolds, is gradually replaced in importance in the south Cotswolds by the Great Oolite which forms the uplands overlooking the Avon Valley at Bath.

On the dip slopes, the limestones, falling gently eastward towards the Oxford Clay vales, give rise to a high undulating plateau, partly arable, partly downland, drained by the headwaters of the Thames and Avon, and providing shelter in its deep valleys for villages and mansions built of mellow freestone.

South of the Mendips no great single escarpment is present. Its place is taken by two step-like ridges; the lower and more westerly, formed by the Inferior Oolite, is separated from the higher scarp of the Forest Marble by a tract of Fuller's Earth Clay and Frome Clay in which the Fuller's Earth Rock makes a minor feature. East of the Forest Marble ridge lies a wide expanse of the heavy Oxford Clay, bordered on its eastern margin by the escarpments of the Upper Greensand and Chalk.

A widely different type of scenery, covering some 700 km², is that produced by the estuarine alluvium that flanks both sides of the Bristol Channel. The most extensive area lies south of the Mendips and is known as the Somerset Levels. Various parts of the area are known as Moors or Heaths, as for example Sedgemoor and Meare Heath. Much of the ground is below high-tide level and is protected from marine inundation by dunes of blown sand and sea walls. The rivers Axe, Brue,

Parret and Cary (the last continuing seaward as the artificial King's Sedgemoor Drain) flow sluggishly westwards through an extensive region of pasture fields bounded by willow-lined ditches or 'rhines'. The flat landscape throws into relief the steep southern face of the Mendips ([P206222](#)), the inliers of Mesozoic rocks which form the Polden Hills and the striking residual hills of Glastonbury Tor and Brent Knoll.

## Early geological works

Of all the names connected with the geology of the district none is more illustrious than that of William Smith, the 'Father of English Geology'. Whilst engaged in surveying the Somerset Coal Canal in 1792-95, he discovered the fundamental principles of stratigraphy, i.e. the constancy of the order of succession of the strata and the characterisation of each stratum by certain fossil species. In 1799 he coloured geologically the 'Map of Five Miles around the City of Bath', one of the oldest geological maps in existence. At Bath in June of the same year, he dictated his 'Tabular View of the Order of Strata' to his friends Townsend and Richardson.

The official Geological Survey maps at 1 inch to 1 mile of the Bristol-Gloucester district all appeared between 1845 and 1857 and were the results of the labours of such well-known men as Sir Henry T De la Beche, John Phillips, A C Ramsay, H W Bristow, W T Aveline, D H Williams and Edward Hull.

Mention must also be made of the remarkable set of 19 sheets of maps of the Bristol area, on the scale of 4 inches to 1 mile, produced in 1862 by William Sanders. These maps formed the basis of the local work of the 1871 Coal Commission in which John Anstie played a great part.

In addition to the official maps and publications, there are descriptions of the geology of the district by many private workers. The name of Weaver will be remembered for his observations on the Silurian rocks of Tortworth, and that of Charles Moore for his labours on the Rhaetic and Liassic rocks.

Much of our present knowledge of the Somerset Coalfield is due to the detailed work of James McMurtrie, whilst in literature on the Carboniferous Limestone the name of Arthur Vaughan stands pre-eminent. The lucid and stimulating papers of Charles Lloyd Morgan did much to inspire research into the geological history and structure of the Bristol district and had the effect of arousing great popular interest in the science.

Many well-known names figure in works upon the 'Oolites': Wright, Lycett, Hudleston and Witchell to mention a few, but the most famous is that of S S Buckman, whose work is referred to later.

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Category:

- [Bristol and Gloucester region](#)

## Navigation menu

### Personal tools

- Not logged in
- [Talk](#)

- [Contributions](#)
- [Log in](#)
- [Request account](#)

## Namespaces

- [Page](#)
- [Discussion](#)

## Variants

## Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)

## More

## Search

## Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

## Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

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