

Geology in Devon

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www.devon.gov.uk

Devon
County Council 

Introduction



© Peter Wakeley/Natural England

Dawlish Warren

Why does Devon look the way it does?

Climate has played a role, with Devon's wet and mild weather influencing how the land has been farmed and what plants grow here. People have changed the landscape through farming and by building houses, roads and industry.

But what is it that really governs what crops and wild plants will flourish, and why build homes and set up industry in one place and not another?

As you may have guessed, the fundamental answer to these questions is usually 'the geology'. The rocks beneath our feet influence the soils in which plants grow and have traditionally provided local communities with building materials. The locations of the hills, valleys and estuaries that we see today have strongly shaped the pattern of human settlement.

Whether we know it or not, we all have a close relationship with geology! In Devon, the wonderful diversity of landscapes and wild habitats that continually delight thousands of tourists and locals alike closely reflect the County's varied geology.

You may know not know much about geology – few of us do. Don't worry! This is not a booklet



© Robin Bevis DCC

Granite Way

for geologists. It is here to help anyone with an interest in the natural world to discover Devon's geology and at the same time to experience the beautiful landscapes and diverse wildlife that can be found throughout the coast and countryside of Devon.

Many of the sites also have a rich historic interest, such as the Napoleonic fort at Berry Head, Torbay. What's more, Devon has two World Heritage Sites with geological interest, including the famous 'Jurassic Coast'. With so much to see, why not get out and enjoy Devon's natural history for yourself?

Access to much of the County has never been better. An integrated bus and train network, 3500 miles of footpath, 734 miles of bridleways and 150 miles of the National Cycle Network allow you to explore the countryside without the need for a car. Make your visit even more special and help to preserve Devon's natural beauty for others.

For further information on Devon's geology, wildlife and other attractions, please visit the Visit Devon web site: www.visitdevon.co.uk. For information on public transport please visit www.traveline.org.uk or call the Traveline number 0871 200 22 33 (calls from landlines cost 10p per minute).

A flavour of Devon's geology

Devon has a varied and ancient geology and as you travel around the County this variety is clearly reflected in the diverse landscape.

The uplands are dominated by the granite of Dartmoor and the sandstones, slates and other sedimentary rocks of Exmoor. The upland character of both of these National Parks was strongly influenced by a period of mountain building caused by tectonic plate collision. The nature of these rocks together with the climate has created acidic soils that have helped to give these areas their moorland nature.

In the central belt of the County between Dartmoor and Exmoor the Culm Measures of Carboniferous age, laid down between 354 to 290 million years ago, give rise to a characteristic wet, acidic rushy and heathy grassland where the rocks are rich in shale. However, when sandstones predominate over shale the soil is better drained and supports arable farming.

In contrast, limestone, the remains of countless numbers of marine organisms, can be found in areas along the south coast such as at Hope's Nose and Berry Head in Torbay. At the last locality towering limestone cliffs now support

species-rich grassland and provide a home for the largest breeding colony of guillemots on the south coast of England. This limestone is one of the oldest rocks in the County, being laid down during the Devonian Period (417 to 354 million years ago), a part of geological history named by the Victorians after this very county.

Visitors to Devon are often struck by the red soils, particularly visible in a broad area around and to the east of Exeter. The colour is caused by iron oxide present in sandstones laid down in the arid desert conditions of the Permian and Triassic periods, 290 to 206 million years ago. And during the Cretaceous Period, which began about 144 million years ago, the Greensand was deposited and this now remains on the high ridges of the Blackdowns in the east and the Haldon Hills near Exeter. Overlying Chalk occurs in the Beer area in East Devon and once overlay the Greensand on the Haldon Hills.

Devon's geology has an influence well beyond its borders. About 30 million years ago during the Tertiary Period the huge Sticklepath Fault that runs north-west to south-east across the County caused local subsidence creating basins such as that found at Bovey Tracey, south-east of





© Peter Wakely/Natural England

Combe Martin

Dartmoor. Sand, clay and lignite accumulated within these basins and this included ball clay, now used in a wide variety of products exported far and wide.

These are just a few examples of the County's rich geological medley but it is more than just the sheer variety of rocks that makes Devon special. The land was never covered by the glaciers of the Ice Age, the southernmost of which only reached the north coast of Devon. As a result, the Ice Age has a smaller effect on the landscape of Devon than most parts of Britain, and the relationship between the bedrocks and the resulting landform can be clearly seen. That said, the proximity of these great masses of ice did not pass unnoticed, as can be seen on Dartmoor where the effects of freezing and thawing can be witnessed in the tors that are so characteristic of the area today.

Geology gives an unrivalled insight into the history of the Earth but it is worth remembering that the processes that have helped to shape the planet are still at work as can be seen in such dynamic landscapes as the sand dunes of Dawlish Warren in the Exe Estuary.

Further information on Devon's geology

If you want to dig deeper into the geology of Devon there are many sources of information you can explore. Here are just a few:

- The Educational Register of Geological Sites in Devon:
www.devon.gov.uk/geology
- The Devon Biodiversity Action Plan has a useful summary of Devon's geology:
www.devon.gov.uk/biodiversity
- Devon Regionally Important Geological Sites group: www.devonrigs.org.uk
- Devon's Geology – an introduction, written by Robert Hesketh and published by Bossiney Books.
- In September 2007 Torbay was given UNESCO GeoPark Status in recognition of the area's international importance for geology. There are 32 geosites covering a story of 3 geological time periods, all found within a compact area. A great deal of interesting information on Torbay's dramatic geological story can be found at the associated website:
www.englishrivierageopark.org.uk.
- The Jurassic Coast Trust has published a book entitled *The Red Coast Revealed*, the first in a series of geological guides to the Jurassic Coast World Heritage Site which extends along the East Devon and Dorset Coast.

The following books are out of print but can be easily obtained through Devon libraries or second hand:

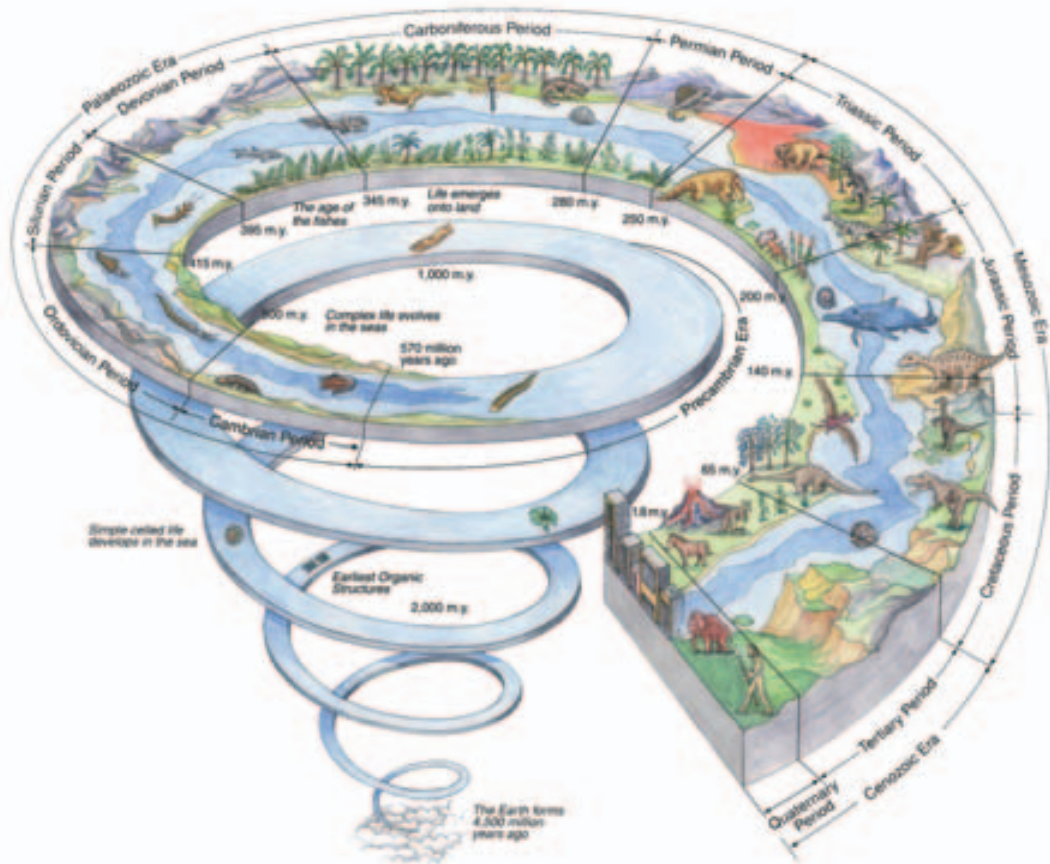
The Geology of Devon

edited by Durrance & Laming and published by the University of Exeter Press.

Geology Explained in South and East Devon

written by John Perkins and published by David and Charles.

Geological Timeline



The Coast and Moors



Fulmar nesting

© Paul Glendell/Natural England

The Coast

Devon is unique in the UK in having two separate coastlines, with a total length of over 400 km. They offer a marvellous opportunity to view Devon's geology whilst at the same time experiencing some of the England's most beautiful and atmospheric landscapes.

Along the north coast are impressive towering cliffs of sandstones and mudstones, often showing dramatic folds in the rocks caused by the huge forces that have been at work here in the ancient past. Many beaches can also be found, as well as the famous, massive sand dune system of Braunton Burrows.

The gentler south coast is perhaps even more varied. Frequent estuaries punctuate the coastline, many being deep river valleys that have been drowned by rising sea levels in the past. To the east lies the 'Jurassic Coast' World Heritage Site, offering a unique 'walk through time' and the chance to admire impressive sea stacks and land slips. The limestone cliffs of Berry Head, visually stunning, clearly demonstrate the links between geology and wildlife, and the coastline of Start and Prawle Points, to the far south, has a beauty unequalled.

These are just a few highlights to provide a flavour of Devon's coastal resource. The South West Coast Path runs along both coasts, offering great access and spectacular views at any time of year:

www.southwestcoastpath.com





Sheeps Tor & Burrator Reservoir



The Moors

The upland National Parks of Dartmoor and Exmoor present a wild and striking contrast to the more rolling, fertile lowlands that cover much of Devon.

However, each National Park has its own unique personality, the differences between them reflecting their underlying geology.

Exmoor is underlain by sedimentary rocks such as sandstones and slates. Originally, these were mostly laid down in the shallow waters of seas, lakes and river deltas during the Devonian (417 – 354 million years ago) and Carboniferous (354 – 290 m.y.a.) periods. So why is Exmoor now such a dramatic upland landscape? The explanation can be found in the ancient movement of the Earth's crust. A period of tectonic plate collision caused intense pressure resulting in the rocks being compressed, folded like a concertina and faulted. Exmoor is an upfaulted block of harder Devonian rocks which contrasts with the softer rocks of the Carboniferous age to the south. During the subsequent eons there has been a considerable degree of erosion which has sliced through layers of rocks of different ages, meaning that the geology of a variety of times is now exposed in the cliffs and steep valley sides.

Dartmoor's story is different. Here, the underlying rock is mostly granite. Indeed, Dartmoor represents the largest area of exposed granite in southern Britain. During the period of earth movement described above, the pressures resulted in the rocks melting at depth. The resulting magma pushed up – or intruded – into the Devonian and Carboniferous sedimentary rocks above before cooling to become granite.

The forces of erosion then exposed the granite. Interestingly, the circulation of fluids during the cooling of the solidified granite led to the concentration of many minerals, such as tin and copper, and signs of past mining activity can be seen throughout the moor.

Perhaps the most obvious geological features of Dartmoor are its tors. These are the result of erosion caused by both chemical weathering and the severe climatic conditions of the Ice Age. Initially, water ran through the natural cracks within the granite and ate away at the rocks. Later, after the granite was exposed, the freeze-thaw conditions of the Ice Age worked away at the rocks, creating the structures we see today. Whilst glaciers did not reach Dartmoor, there are many other landforms resulting from the effects of extreme cold during the last Ice Age that can be seen on Dartmoor.

For further information on Dartmoor and Exmoor

Dartmoor National Park
call 01822 890414 or visit
www.dartmoor-npa.gov.uk



Exmoor National Park
call 01398 323665 or visit
www.exmoor-nationalpark.gov.uk
or www.visit-exmoor.info



EXMOOR
NATIONAL PARK

World Heritage Sites

What do the Great Wall of China, India's Taj Mahal or the historic centre of Rome have in common? They are all World Heritage Sites, recognised by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) for their outstanding international importance. Devon is blessed with two of these world class sites.

The Dorset and East Devon Coast WHS (inscribed in 2001)

Commonly known as the 'Jurassic Coast', this site runs the 95 miles from

Exmouth in Devon to Studland Bay in Dorset. Packed into this short stretch of coast are 187 million years of geological time, spanning the Triassic, Jurassic and Cretaceous Periods. This means that, the rocks here date from between 252 and 65 million years ago.

Usually you would expect to find younger rocks at the top of cliffs and older rocks below. However, along this coast past earth movement has caused a tilt in the rocks. Combined with the effects of erosion this means that today you can take a unique 'walk through time', passing over the older rocks in the west to encounter younger rocks as you head east.

As you go you will experience stunning coastal landscapes of steep cliffs, isolated sea stacks and massive landslips. Many of the rocks were laid down in marine conditions and are often rich in fossils. Indeed, this coast has long been an important location for the study of ancient life.

The area is easily accessed by land and sea. The South West Coast Path National Trail runs along its entire length, boat trips are available and it is well served by the Jurassic Coast bus (X53).

Much of Devon's Jurassic Coast is featured in the individual site descriptions in this booklet but these can only hint at the fascinating story to be read from the rocks. For more information on this site, places to visit and how to get there please visit www.jurassiccoast.com



Cornwall and West Devon Mining Landscape WHS

(inscribed in 2006)



Geology can strongly influence cultural heritage and this can be clearly seen in the Cornwall and West Devon Mining Landscape ('Cornish Mining').

This World Heritage Site covers select mining landscapes dating from 1700 to 1914. During this time the mining and processing of copper, tin, arsenic and other industrial metals led to major technological developments, particularly in steam engineering, which helped to transform mining both locally and worldwide and significantly contributed to the Industrial Revolution. This explosive period of activity has left a fascinating legacy of mines, associated infrastructure and a unique and wider cultural landscape, and had a significant economic and cultural impact not only in Cornwall and Devon but around the world.

Within Devon, considerable mining activity took place in the Tamar Valley and Tavistock. This included the famous Devon Great Consols, once the richest copper mine in Europe and for a period the largest producer of arsenic in the world. Copper ore and arsenic were exported from the various mines by ship and a number of small quays were established along the Tamar. One such example, Morwellham Quay, is now a museum and visitor centre that includes George and Charlotte, a former copper mine. The town of Tavistock is a testament to the wealth that the mining generated in the locality. Of medieval origin, it was dramatically remodelled by the Duke of Bedford in the mid-19th century using the considerable profits from his mining investments.

There is a great deal of mining heritage to explore in this part of Devon and much of it is also an Area of Outstanding Natural Beauty. For more information please visit www.cornishmining.org.uk



© B Gamble/Cornwall County Council

Devon Great Consols

Abbreviations used in this booklet

AONB	Area of Outstanding Natural Beauty
LNR	Local Nature Reserve
MNR	Marine Nature Reserve
NNR	National Nature Reserve
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
VMCA	Voluntary Marine Conservation Area
WHS	World Heritage Site



Easy Access routes available



Admission charge applies

Your safety and the conservation of geological specimens

A little care and consideration for your safety and surroundings can help us all to continue to enjoy Devon's wonderful environment and its unique geological heritage.

Use your common sense and please:

- Follow the Country Code: www.countrysideaccess.gov.uk
- Keep to established public footpaths along the coast. Wear appropriate footwear – paths can be uneven and slippery when wet.
- Stay away from cliff edges and quarry faces and do not stand beneath them – beware falling rocks.
- When planning your trip please check the weather conditions and do not explore the coast alone. Always let someone know where you are going.
- Check tide times and aim to be on the beaches during a falling tide. Be aware of incoming tides and large waves.
- Do not attempt to climb cliffs or quarry faces.
- The best place to look for fossils is where they are loose on the beach.
- Do not remove fossils or other geological specimens from cliffs or other features where they are embedded in the rock. These are important for scientific study and education.
- Keep all collecting to a minimum and report interesting finds.
- Many sites are privately owned and many are also Sites of Special Scientific Interest – collecting specimens will require permission.
- Observe local notices.

The maps in this booklet are for guidance only, used to generally indicate the areas described in the text. They do not imply free and easy access throughout these areas. Please respect private property and if somewhere looks difficult or dangerous to access, do not attempt to go there.

Geology in Devon



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Western Devon and Dartmoor

1. Blackingstone Rock
2. The Granite Way
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4. Brent Tor
5. Merrivale
6. Bellever Tor & Higher Cherrybrook Bridge Quarry
7. Burrator Quarries
8. Tavistock & Tavistock Railway Cutting
9. Morwellham Quay

Southern Devon

10. Plym Valley Trail
11. Plymouth Sound, Shores & Cliffs
12. Wembury
13. Ivybridge & the Erme Valley
14. Blackdown Rings
15. Start Point to Prawle Point
16. Slapton Ley & Slapton Sands
17. Berry Head to Sharkham Point
18. Daddyhole
19. Kents Cavern
20. Hope's Nose to Walls Hill
21. Dawlish Warren & Cliffs

Eastern Devon

22. Orcombe Point to Lympstone
23. Budleigh Salterton Cliffs & the Otter Estuary
24. Ladram Bay to Sidmouth
25. Sidmouth to Beer Coast
26. Beer Quarry Caves
27. Axmouth to Lyme Regis Undercliffs
28. Exeter City Walls & Cathedral
29. Brampford Speke
30. Killerton Park

Northern Devon and Exmoor

31. Lynmouth area
32. Combe Martin Bay to Hele Bay
33. Woolacombe to Ilfracombe
34. Lundy
35. Baggly Point to Saunton
36. Braunton Burrows
37. Westward Ho! Cliffs & Northam Burrows
38. Codden Hill Viewpoint
39. Hartland Point to Hartland Quay
40. Barley Grove & Torrington Common

Western Devon and Dartmoor

1. Blackingstone Rock

Nearest town: Moretonhampstead

OS grid reference: SX 786 856

Status: National Park

Management: Dartmoor National Park Authority



© Dartmoor National Park Authority

Blackingstone Rock is a large tor situated in the eastern part of Dartmoor National Park. It exhibits many of the typical features of the Dartmoor Granite. Of particular note is that the coarse grained granite contains very large crystals of feldspar. The term 'feldspar' encompasses a group of pale coloured rock-forming minerals; Blackingstone Rock has examples up to several centimetres long. The tor also displays characteristic jointing.

Facilities

There is a display board describing the tor, including an outline of the geology, in the car park.

Access

Foot: There is access on foot to the open area around the rock, this is best accessed using the path which runs northwest around the tor and ascends gently. Please do not climb straight up to the top of the rock from the car park as this causes erosion and may damage rare lichens. There is a flat route to the base of the rock using a footpath from the layby at SX 785 856. **Bus:** There are regular bus services to nearby Moretonhampstead from Exeter and Newton



Abbot. Road: From Exeter take the B3212 towards Moretonhampstead, after passing through Doccombe turn left towards Blackingstone and Blackingstone Rock at Cossick Cross junction.

For further information on the geology of this site please view

www.devon.gov.uk/geo-BKR.pdf.

2. The Granite Way



Nearest towns: Okehampton & Lydford

OS grid reference: SX 517 852 - SX 589 944

Management:

Devon County Council



The Granite Way is an 11 mile cycle and walkway running between Okehampton and Lydford along the north western edge of Dartmoor. It is mostly traffic free, largely following the course of the former Southern Region railway line. A journey along the Granite Way offers good views of the granite landscape of Dartmoor, as well as a number of specific sites of geological interest.



© Robin Bevis DCC



For example, close to the Okehampton end of the route is Meldon Quarry. This large working site, largely hidden in the landscape, produces hard rock such as hornfels. This is used in a variety of ways but in particular it has provided the aggregates for road building and rail ballast since 1895.

Further south can be seen the impressive silhouette of Sourton Tors (they can be reached by a footpath north of Sourton). Unlike most of Dartmoor's tors they are not made of granite. Instead they also consist of hornfels that, as at Meldon, were created by heating when hot granite intruded into the original rocks of this area. The actual point of contact between these rocks with the granite is a kilometre or so farther south-east. As you look out onto Dartmoor you see an area which was once a plateau and can observe how over millions of years rivers have cut through the rock creating distinctive valleys.

At the southern end of the trail is the famous Lydford Gorge, which is covered by a separate entry in this booklet.

Facilities

Okehampton and Lydford contain a good range of facilities, and there is a visitor centre and café at Meldon Viaduct, near the Quarry.

Access

Okehampton: Bus: There are regular services from Exeter, Bude, Plymouth and Barnstaple. **Train:** Limited service from Exeter on summer Sundays. **Road:** From the A30 follow signs to Okehampton station along the B3260. **Bicycle:** The site is part of the National Cycle Route 27 "Devon Coast to Coast". For more information, view www.sustrans.co.uk for other routes that connect to Route 27.

Lydford: Bus: There is a regular service operated between Plymouth and Barnstaple. **Road:** via the A386 at Dartmoor Inn, follow signs for Lydford/ Lydford Gorge.



For more information on the Granite Way please view the leaflet at

www.devon.gov.uk/the_granite_way.pdf, also available at Tourist Information Centres. A comprehensive booklet on the geology of the Meldon area has been produced and can be downloaded from the website of the Dartmoor National Park Authority.

3. Lydford Gorge



Nearest Town: Tavistock

OS grid reference: SX 503839

Status: SSSI, National Park

Management: National Trust



The impressive Lydford Gorge has a depth of 35 metres, is almost 2 km long and is of considerable importance for interpreting the geology of the local area. Within the gorge it is possible to see extensive exposures of mudstones, sandstones, limestones and cherts ranging in age from Upper Devonian (c370 million years) to Lower Carboniferous age (350 million years). Some of these rocks contain important fossil remains that have proved crucial in dating the geology.

Western Devon and Dartmoor



© NTPL/David Noton

However, perhaps the most impressive aspect of the site is the structure of the gorge itself. This provides a classic example of river gorge formation followed by 'river capture' and has many features associated with this process. These include the spectacular 27 metre high Whitelady waterfall and the exciting Devil's Cauldron whirlpool, along with the imprints of potholes now many metres above the present river level.

Facilities

Admission charges apply. There is a tea-room, shop and during the winter access is to the waterfall only. Walking in the gorge is strenuous. It is extremely rugged, with uneven surfaces,

slippery paths and vertical drops. Walking boots are essential. Please also refer to the safety guidance at the start of this booklet.

Access

Foot: Circular walk of 3 miles or short walks to Devil's Cauldron and Whitelady Waterfall.

Bicycle: Lydford Gorge is close to two cycle routes: Devon Coast to Coast and the Plym Valley.

Bus: A number of buses stop at Lydford Gorge, including ones from Plymouth. **Road:** Lydford Gorge is halfway between Okehampton and Tavistock, 1 mile west of the A386 opposite the Dartmoor Inn. The main entrance is at the west end of Lydford village and the waterfall entrance is 1 mile along the road from the main entrance.

For details on opening dates and times and admission charges visit www.nationaltrust.org.uk or email lydfordgorge@nationaltrust.org.uk or call the National Trust on 01822 820320 or 820441.

Further geological details are available at www.devon.geo.uk/geo-LYG.pdf

4. Brent Tor

Nearest Town: Tavistock

OS grid reference: SX 471804

Status: SSSI, National Park

Management: Private landowner

Brent Tor is one of the most impressive rock outcrops in Dartmoor. With St Michael's Church at its top, it makes a distinctive and famous silhouette on the Dartmoor skyline.

The Tor is unusual as it is one of the few on Dartmoor not to be made of granite. In fact, it is formed from basaltic lava which flowed some 350 million years ago into a shallow sea that covered the area during the Lower Carboniferous and Devonian periods. As the lavas flowed out into the sea some solidified into globular masses known as pillow lavas. Others were broken up by explosive contact with the sea water.

This lava formed a mound on the sea floor which was then eroded by sea currents with the



© Peter Chamberlain



© Dartmoor National Park Authority

resulting debris being washed down the slopes of the mound. Debris of this nature can still be seen loose on the southern slopes of the Tor.

Facilities

Car parking and toilets are available directly west of the site, north west of Heathfield Plantation. Access to the site entrance is at the northern end near the Stag's Head House, gained via roadside pavement.

Access

Road: If accessed from Exeter the route is round the north side of Dartmoor on the A30 leaving it at Sourton and proceeding towards Tavistock. A local road south-west from Lydford reaches North Brentor village. The car park is just below Brent Tor itself. **Bus:** Services run between Okehampton and Tavistock, stopping at nearby North Brentor. **Bicycle:** The National Cycle Network Route 27 (Plymouth to Ilfracombe) is near to the site (see www.sustrans.co.uk).

For further information on this site please view www.devon.gov.uk/geo-BRT.pdf

5. Merrivale

Nearest Town: Tavistock

OS grid reference: SX 540760

Status: SSSI, National Park

Management: Various
(owned by Duchy of Cornwall)

Located on the west side of Dartmoor, this site is home to a number of impressive landforms that are defined by the underlying geology and demonstrate the effects of weathering during the Ice Age. Dartmoor was never glaciated but still suffered the effects of the cold conditions, known as periglacial activity. Solid ice sheets came as far south as the coast of North Devon.

The area has a number of tors, including Roos Tor, Cox Tor and the Staple Tors. These Tors were exposed when the overlying material was eroded by periglacial activity. They are surrounded by areas of clutter (rock debris) and blockfields (flat or only gently sloping areas of frost-shattered rock), and boulder runs are also present.

The slopes around Cox Tor display a number of unusual earth hummocks. These vary considerably in size and shape but can be up to two metres in diameter and about 0.5 metres high. They are generally composed of a fine silty loam that again resulted from weathering during the Ice Age.

Facilities

There is car parking on the B3357 Tavistock to Princetown road.

Access

This area of Dartmoor is common land to which there is free access on foot. Merrivale Granite quarry is private.

Foot: One public footpath runs through the site. (N.B Visitors should avoid walking on the delicate earth hummock features and use existing paths wherever possible).



Western Devon and Dartmoor

Road: The site can be approached from car parks on the B3357 Tavistock to Princetown road. The land immediately to the north of the site is used by the Ministry of Defence as a firing range and is therefore classed as a 'Danger Area'; access is subject to a range of restrictions (see www.dartmoor-ranges.co.uk).

Bus: There is a regular service between Tavistock and Merrivale and Princetown.

For more information on the geology of Dartmoor and this site please view www.dartmoor-npa.gov.uk or www.devon.gov.uk/geo-MVL.pdf

6. Bellever Tor & Higher Cherrybrook Bridge Quarry

Nearest Town: Princetown

OS grid reference: SX 645764 & SX 635771

Status: National Park

Management: Forestry Commission



Situated in the centre of Dartmoor National Park, the area around Bellever Tor is easily accessible and is a popular site for walkers. It provides a good example of a hill-crest granite tor. Features seen here and at the nearby Cherrybrook Bridge Quarry illustrate the effects of weathering on granite and give a good indication of how the Dartmoor tors were formed.

From the adjoining Forestry Commission plantation, there is a pleasant and relatively gentle walk up the moorland slopes towards the summit of Bellever Tor. The tor shows well developed and flat-lying tabular jointing. Weathering has penetrated these joints causing the disintegration of the granite into large slabs which now form the debris, known as clitter that surrounds the tor. The tor is also cut by widely-spaced vertical joints which have weathered into broad gullies.



The effects of weathering on granite are also well demonstrated at the nearby Higher Cherrybrook Quarry, located by the roadside some 2km to the northwest of Bellever Tor. Here, the degree of loosening and weakening of the granite can be related to the proximity to the joints which, over millions of years, have allowed the rock to be attacked through the chemical and physical forces of water.

In addition to its geological significance, the site offers excellent views over South Dartmoor. The area also exhibits many remains of prehistoric settlement, including tombs and stone rows and circles.



7. Burrator Quarries

Nearest Town: Yelverton

OS grid reference: SX 549 677

Status: SSSI, National Park

Management:

South West Lakes Trust



Located on the south-western edge of Dartmoor close to the impressive Burrator Reservoir are the disused Upper and Lower Burrator Quarries.

The Upper Burrator Quarry offers an opportunity to view a rare exposure of the contact between the Dartmoor granite and Devonian rocks. Indeed, veins of pink granite can be seen penetrating these rocks which were once slates resulting from the deep burial and intense deformation of mudstone originally laid down in marine conditions. However, the high temperatures that resulted from the intrusion of the hot granite transformed them into re-crystallised rocks known as hornfels. Minerals such as black tourmaline have been formed in the original slate.

The Lower Burrator Quarry exposes granite intersected by a series of joints. Joints are fractures in the granite resulting from stresses caused by cooling, by pressures from earth movements or by the removal of a load when the rocks once above the granite are eroded away.

Facilities

There are a number of car parks near the site.

Access

Foot: The site is best accessed on foot via the forestry tracks leading from the Forestry Commission car parks at Bellever Forest. **Road:** From the B3212 between Postbridge and Two Bridges there is direct access to the quarry / car park site at Higher Cherrybrook Quarry. **Bus:** There are a few daily services from Princetown to Bellever.

See the factsheet on tor formation (including a case study at Higher Cherrybrook Quarry) at www.dartmoor-npa.gov.uk/lab-tors.pdf. Additional information is available at www.devon.gov.uk/geo-BET.pdf (& geo-HCB.pdf).



Western Devon and Dartmoor

A booklet entitled 'The evolution of a Dartmoor Landscape - exploring Burrator' by Peter Keene gives more detail on the geology of the quarries and the Burrator area in general. It is available to download or purchase at the Dartmoor National Park Authority web site.

Access

Foot: Both of the quarries are situated on Yennadon Down which is common land. You can roam freely on foot and on horseback.

Bus: There is a regular bus service from Yelverton to the nearby village of Dousland. There is also a regular service to Yelverton from Tavistock and Plymouth. **Road:** The site is accessed from the minor road heading east from Yelverton towards Burrator Reservoir. The site lies west of the road approximately 300 metres south of the reservoir's dam. Car parking is available in the southern quarry. **Bicycle:** National Cycle Network Route 27 'Devon Coast to Coast' from Plymouth to Ilfracombe runs near to Yelverton and the site.

For further information on this site, please view www.devon.gov.uk/geo-BUQ.pdf, or www.swlakestrust.org.uk.



8. Tavistock & Tavistock Railway Cutting

Nearest City: Plymouth

OS grid reference: SX 484 740

Status: LNR, WHS



Management: Tavistock Town Council, West Devon Borough Council & private landowners
Tavistock, originally founded in 974 AD with the building of the Benedictine Abbey, has been greatly influenced by the local geology. The surrounding area once supported a thriving mining industry. Indeed, the extraction of minerals such as tin, copper and arsenic is documented as early as 1305.



Tavistock is now a part of the Cornwall and West Devon Mining Landscape World Heritage Site in recognition of the considerable legacy of this mining activity. During the nineteenth century the town was completely remodelled by the 7th Duke of Bedford, Francis Russell, and his steward John Benson using the profits gained from mining. In the process a number of impressive public buildings were built, as was model housing for workers - virtually unheard of at the time.

The buildings include the Cornmarket (1835) and the Guildhall (1863). Many were created using a variety of local materials including the green volcanic Hurdwick Stone, quarried just a few miles away, and granite from Pew Tor on Dartmoor. The workers cottages were made from brick and local rubble stone.

The rocks underlying Tavistock can be seen in several places in the town, such as Tavistock Railway Cutting (SX 4722 7413 – SX 4788 7448). Greenish grey Devonian slates occur in the south-western part of the cutting (SX 4722 7413) and towards the road bridge. Beyond this bridge black slates, also Devonian, can be observed. At the north eastern end of the section is evidence of volcanic activity with lavas containing cavities caused by the expansion of trapped gasses and finely grained deposits of volcanic ash.

Facilities

There are shops, cafes and restaurants in Tavistock. Cycle hire is also available.

Access

Road: The A386 connects Tavistock to Plymouth and Okehampton. **Bicycle:** The National Cycle Network Route 27 “Coast to Coast” from Ilfracombe to Plymouth goes through Tavistock.

Bus: There are regular services from Plymouth and Okehampton.

For further information on this site, please view www.cornishmining.org.uk or www.tavistock.gov.uk

9. Morwellham Quay

Nearest town: Tavistock

OS grid reference: SX 445697

Status: AONB, WHS

Management: Morwellham and Tamar Valley Trust



Much of the Tamar Valley in west Devon was once home to a thriving mining industry. This industry needed a transport system and a number of small quays were built along the River Tamar to ship out the mined material. One such example is the restored Morwellham Quay, now an open-air museum and visitor centre.

Copper ore taken from the nearby George and Charlotte mine, first worked in the early 1700s, was shipped from here. This small mine has many features characteristic of the other mines found throughout the Tamar Valley but here you can actually journey underground and experience something of the working conditions of the miners during the 19th century.

Morwellham Quay is part of the Cornwall and West Devon Mining Landscape World Heritage Site.

Facilities

There is a wildlife reserve, woodland trail, shop, playground, museum, refreshments, toilets, car park and restaurant on site.

Access

Bus: There is a regular service between Tavistock bus station and Lumburn with a half an hour walk to the quay. There is a summer Sunday bus service. **Road:** From Tavistock, take the Plymouth road (A386) before joining the A390. From here join the B3257 before turning right to Morwellham Quay. **Boat:** River trips may be available - see www.calstockferry.co.uk.

For more information please visit www.morwellham-quay.co.uk or telephone 01822 832766



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10. Plym Valley Trail

Nearest city: Plymouth

OS grid reference: Cann Quarry SX 524596, Bickleigh Vale Quarries SX 522596.

Management: National Trust & private landowners



The Plym Valley Trail is quite a gentle route for both cyclists and walkers heading out from Plymouth towards Dartmoor. Passing through Plym Bridge Woods, managed by the National Trust, the trail offers great views and the opportunity to get close to wildlife, as well as being of interest to the geologist.



In particular, the disused sites of Cann and Bickleigh Vale quarries are worth a look. Both quarries were used to mine slate, with Cann Quarry being worked as far back as 1683. The slate was used in roofing and flooring, though it was markedly inferior to the Welsh product.

The slate was originally a marine mud which, having been buried and turned into mudstone, was heated and compressed as a result of the tremendous forces at work during a collision of tectonic plates. This process altered the orientation of the minerals within the mudstone allowing it to split easily. That is, it had become slate.

Both quarries are cut by a fine grained granite dyke (molten rock which intrudes into the local rocks). This feature is actually known as an elvan dyke, 'elvan' being an old south-west mining term for granite dykes.

During the breeding season Cann Quarry is home to a pair of peregrine falcons and there is usually a viewing station with telescopes available for use.

Facilities

There are public facilities and refreshments in Plymouth and car parks at Plymbridge to the south.

Access

By foot: Walk along the canal path or the old railway cycle route from the National Trust car park approximately 1 km to the south. Both quarries lie either side of the River Plym, Cann to the east and Bickleigh Vale to the west. **Bicycle:** Plym Valley Trail National Cycle Network route 27. **Road:** From Marsh Mills junction of A38 go to Plympton. Turn left onto Plymbridge Road (Plymbridge is in the middle of Plymbridge Road and is closed to through traffic). **Bus:** A regular service runs between the centre of Plymouth and Colwill road (with 1 change and 800m walk to Plymbridge Road).



Further information: please view www.nationaltrust.org.uk or call 0870 458 4000. Further details on the geology of these sites are available at www.devon.gov.uk/geo-BVQ.pdf and www.devon.gov.uk/geo-CAQ.pdf

11. Plymouth Sound, Shores and Cliffs

Nearest City: Plymouth

OS grid reference: SX 492 497– SX 487 533

Status: AONB, SSSI, SAC

Management: Ministry of Defence & private landowners

This magnificent coastal section runs along the eastern side of Plymouth Sound from Andurn Point northwards to Mount Batten Point. As you travel along this route you can experience a varied and impressive geology. The rocks become younger as you head north but all were laid down during the Devonian Period (417 - 354 million years ago), named after this county.

The southernmost outcrops at Andurn Point consist mainly of red and green slates with sandstones that were deposited in lakes and rivers in seasonally arid conditions. Heading north, the dominant rocks are slates, siltstones and sandstones but these are greyer in colour and contain some marine fossils, indicating

flooding of a continental edge by the incoming of the sea.

At Bovisand Bay the harder Staddon Grits appear and form the headland from Staddon Point northward. The sandstones in this formation were deposited in marine sand bars. To the north, most of Jenny Cliff Bay is cut into softer and younger marine slates but the northernmost promontory of Mount Batten Point is made of limestone laid down in a clear warm tropical sea.

Along most of this coast you can observe dramatic faults and folds in the rocks, sometimes producing a chevron pattern. These give clear evidence of the terrific pressures that were exerted on the rocks during a period of tectonic plate collision between 330 and 300 million years ago.

Access

Beaches are only accessible at low tide; Crownhill Bay has cliff access to the beach. **Road:** Site accessed from minor roads leading to the beaches. There is one car park towards the north end of Jennycliff. There is another parking site beside the road leading down to Fort Bovisand to the east of Bovisand. Beach café open during the season. **Foot:** The South West Coast Path winds along the site. **Bus:** There is a regular service from Plymouth (Royal Parade) to Turnchapel.

For more information on the geology please view www.devon.gov.uk/geo-PSC.pdf.



12. Wembury

Nearest City: Plymouth

OS grid reference: SX 520485 - 504485

Status: VMCA, AONB, SSSI, SAC

Management: National Trust



This site spans from Wembury Beach west to Wembury Point. This area has been designated an Area of Outstanding Natural Beauty and no visitor can fail to be impressed by the magnificent coastline.

The foreshore and cliffs expose excellent sections of Lower Devonian rocks - mainly red mudrocks, now metamorphosed to slate, siltstones and sandstones. These are thought to have been originally laid down in mudflats and floodplains

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associated with lakes. Some fossil fish remains have been found here and there may have been an occasional connection between these lakes and the nearby sea. In places, folds in the rock can be seen – an indication of the vast forces that have been at work here in the ancient past.

Interestingly, a raised beach platform and a fossilised cliff line can be seen at the back of the modern beach. This is largely covered by a stony deposit (known as 'head') formed by downward soil movement during the freeze/thaw conditions of the Ice Age, though at Wembury Point itself some remains of the original beach cobble can still be seen.

Facilities

The Wembury Marine centre is operated by the Devon Wildlife Trust.

Access

Foot: The South West Coast Path and Erme-Plym Trail runs throughout the area. **Bicycle:** The area is easily accessible by bicycle – close links with the National Cycle Network. **Road:** Take the A379 at Elburton on the east side of Plymstock and follow signs for Wembury and Wembury Beach. Parking is available at the National Trust car park. **Bus:** There is a regular service between Plymouth and Wembury.



For further information on this site's geology please visit www.devon.gov.uk/geo-WMP.pdf. For more information on the VMCA please view www.devonwildlifetrust.org and www.wemburymarinecentre.org or call 01752 862538. See also www.nationaltrust.org.uk

13. Ivybridge & the Erme Valley

Nearest town: Ivybridge

OS grid reference: SX 633 557 – SX 643558 – SX 633589

Management: Private landowners

The areas of Ivybridge Town and the valley of the River Erme to the north and south are very interesting for their geological features.

Exposures in the River Erme north of the railway viaduct show Upper Devonian slates that have been baked by the intrusion of hot granite. Dykes of very fine grained granite (known as aplite) are exposed in the river (at SX 6385 5710) and just above this a sheet-like mass of aplite forms the river bed and is intruded into the slates. Providing the water is not too high, the contact of the main body of the granite with the slates can be seen at SX 6375 5740.

Of particular interest in this area is a large boulder outwash fan which extends south from the mouth of the Erme Gorge. These boulders



were probably deposited during a torrential flash flood during the Ice Age. Part of Ivybridge is built on this fan, and its presence can be witnessed by the use of the boulders as building material in the lower parts of the town, as well as in old field banks in the surrounding countryside.

Facilities

There are cafes, shops and toilets in Ivybridge.

Access

Foot: The area is easily accessed by public footpaths. The Erme Valley trail runs 3 miles along the valley from Ivybridge to the village of Ermington; the route is comprehensively way marked. **Bus:** There are regular services from Plymouth to Ivybridge. **Train:** Services from Exeter and Plymouth. **Road:** Ivybridge is just off the A38 from Plymouth to Exeter. Car parking is available in the town. **Bicycle:** A National Cycle Network (on-road) route goes through Ivybridge and when completed will connect to Plymouth.

For more information on the geology of this area please visit www.devon.gov.uk/geo-IEV.pdf

14. Blackdown Rings

Nearest town: Kingsbridge

OS grid reference: SX 720520

Status: AONB, Ancient Monument

Management: The Arundell Charity

This site provides a stunning viewpoint showing the broad geological features of the South Hams. Blackdown Rings consists of an Iron Age hillfort with a Norman motte and bailey castle built within the prehistoric embankment.

The rocks underlying the site, Staddon Grits, can be seen in the commemorative stone by the site entrance. These are harder than the Devonian

slates found to the north and south, so resulting in some of the highest land to the south of Dartmoor. Devon's oldest rocks, those of the Start Complex, are just visible in the distance to the south.

The landforms of the South Hams, seen from this panoramic viewpoint, can be related to the structural trends of the Devonian rocks, which generally follow an east-west orientation. However, this contrasts markedly with the north-south alignment of the deeply-cut valley of the River Avon, which flows nearby.

A permissive path runs northwards into a newly established woodland. Blackdown Rings is also very close to Andrew's Wood, an attractive Devon Wildlife Trust nature reserve.

Facilities

There is an information board detailing the archaeological remains found in the area.

Access

Foot: There is a small car park on site with direct access to the viewpoint and other features. **Bus:** There is no direct service to the site but there are regular buses from Kingsbridge to California Cross (with a 2000m walk). **Road:** The site is sign-posted off the California Cross to Loddisswell road at Blackdown Cross.



Further information is provided at: www.devon.gov.uk/geo-BLR.pdf. For information on the nearby Andrew's Wood nature reserve see: www.devonwildlifetrust.org

15. Start Point to Prawle Point

Nearest town: Kingsbridge/Salcombe

OS grid reference: SX 821376 - 769356

Status: AONB, SSSI, SAC

Management: National Trust & private landowners



Start Point to Prawle Point is a truly beautiful stretch of south Devon coastline. It is underlain by rocks that are very different to those of the rest of Devon. These are known as mica schist, found at Start Point (SX 828372), and hornblende schist, which has a green tint and is found at Prawle Point (SX 772352).

These rocks are the result of intense pressure and heat acting on the original rocks during a collision of tectonic plates. The mica schists were originally shales, siltstones and sandstones, whilst the hornblende schists were once lavas and ashes, all probably of Devonian age.

The area displays good examples of beach platforms including the present wave-cut platform in the intertidal zone. An older beach platform occurs just above the present beach and extends back to an old cliff line. Deposited on this older platform are raised beach deposits which consist of beach sand and cobbles mixed with rock debris, known locally as 'head', deposited as a result of rock movement during the Ice Age.

Facilities

Parking is available at a National Trust car park at Prawle Point, Lannacombe Beach (very limited parking) and Start Point (parking at an Estate car park).

Access

Foot: The South West Coast Path runs through the site. Please note that it is important to stay on the public footpath due to dangerous cliff faces along the site (both above and below the public footpath) and to refer to the safety guidance at the start of this booklet. Please also note that the South West Coastal Path section between Start Point to Prawle Point is quite long (nearly 6 miles). **Road:** The site can be accessed from the A379, via numerous minor roads (easiest access is via minor roads to Prawle Point).



For further details please view www.nationaltrust.org.uk or call 0870 458 4000. More detailed geological information is available here www.devon.gov.uk/geo-PSP.pdf

16. Slapton Ley

Nearest town: Kingsbridge

OS grid reference: SX 835 455 - 845 466

Status: AONB, SSSI, NNR

Management: Field Studies Council



The key geological feature at this wonderful site is a dramatic shingle bar running from Strete Gate south to the village of Torcross. Known as Slapton Sands, it separates the sea from an important freshwater lagoon, Slapton Ley. The ridge is made up of flint, chert and quartz





pebbles, some of which are stained red. It is probable that the major formation of this barrier began about 5000 years ago, during a period of sea level changes. As the sea rose the water transported the shingle ridge ahead of it. This linked the headland at Strete Gate with Torcross, damming a post glacial estuary and forming the freshwater lagoon. The sediments that have accumulated in the lagoon now form an important record of environmental changes since the formation of the ridge.

Replenished with shingle by long shore drift of debris derived from cliffs and from sediments on the sea floor, the ridge remains a dynamic structure and is vulnerable to the power of the sea. Indeed, the road that runs along the ridge has recently had to be realigned.

However, a still more dramatic example of the power of the sea is demonstrated some way to the south, at Hallsands. This fishing village was once protected by a pebble ridge. However, offshore banks focus wave energy at this point and this, perhaps combined with intertidal dredging to acquire materials for the construction of naval dockyards near Plymouth in the late 19th century, led to large scale erosion. In particular, a series of storms in 1917 had devastating effect and by the end of September that year only one house remained habitable.

The ridge and lagoons at Slapton Ley are of national importance for their wildlife, including important communities of plants and breeding and passage birds.

Facilities

Refreshments are available in Slapton and other local villages. There are toilets and picnic sites at the A379 car parks. There is a field centre, a bird hide and access to guided tours on site.

Access

Bus: There is a regular service between Slapton and Dartmouth, Kingsbridge and Plymouth.

Road: Slapton is adjacent to the A379 and Slapton Ley can be accessed by minor roads from the A379. Parking can be a problem in Slapton so it is advisable to use car parks along Slapton Sands. **Foot:** The site is on the South West Coast Path. **Bicycle:** The nearest route is Route 28 of the National Cycle Network.



For more information on the geology of the shingle ridge, please view www.devon.gov.uk/geo-SLL.pdf. Further information on the wildlife of Slapton Ley may be viewed at www.slnnr.org.uk

17. Berry Head to Sharkham Point



Nearest town: Brixham

OS grid reference: SX 941564

Status: AONB, SSSI, NNR, SAC, Ancient Monument

Management: Torbay Coast and Countryside Trust



This dramatic stretch of coastline is of tremendous geological, historical, ecological and landscape importance.

Berry Head is a large headland of Devonian age limestone providing an excellent viewpoint from which to admire Torbay's varied geology and beautiful coastline. Soaring to a height of 195m,

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it is generally flat topped, with a series of cliffs, steep slopes and ledges reaching down to the sea. This limestone was deposited as part of a reef in a tropical sea and is exposed in old quarries at the top of the cliff on the northern side of the site. These provided material for the Napoleonic fortifications that are still well preserved at Berry Head. At Shoalstone Beach wave cut platforms have exposed two sets of red sandstone sedimentary dykes. Some of these are lined with large sparry calcite crystals.

From Sharkham Point it is possible to look back at the impressive cliffs made of limestone and mudstone and see signs of folding. Iron mining used to take place at Sharkham Point, just to the north of the point itself. Besides its use in the production of iron, the haematite ore was powdered and formed the basis for an anti-corrosion paint.

The link between geology and wildlife is clearly demonstrated along this stretch of coast. For example, there are large areas of species-rich limestone grassland, containing a number of rare plants, and different rates of erosion of the cliffs of Berry Head have created a series of ledges which are now home to the largest breeding colony of guillemots on the south coast of England.

Facilities

There are toilets and a café at Berry Head. A visitor centre is open from Easter to late October and an unmanned information point is open all year.



© Paul Glendell/Natural England

Access

Foot: The South West Coast Path runs through the site. Please do not get too close to the cliff edges and refer to the safety notes at the start of this booklet. There is some easy access path at Berry Head. **Train and bus:** There is a mainline train station at nearby Paignton and bus services operate from here to Brixham. **Road:** Access is via the A3022 and the A379. Car parking is available at Berry Head and Sharkham Point. **Boat:** One of the best ways to view the geology of this coastline is by boat and cruises are available along this coast from Torquay, Paignton and Brixham Harbour.

For further information on this site and details of events, please view

www.englishrivierageopark.org.uk,

www.devon.gov.uk/geo-BSP.pdf and

www.countryside-trust.org.uk

or call 01803 882619.

18. Daddyhole

Nearest town: Torquay

OS grid reference: SX 927628

Status: SSSI

Management: Torbay Coast and Countryside Trust



The coastal headland comprises impressive coves, cliffs, foreshore and quarry exposures. Daddyhole Cove, together with a small quarry at Triangle Point to the north-east (accessed via Meadfoot Beach), shows a superb example of limestone from the Devonian period. Underlying the limestone are fine-grained sedimentary rocks known as shales. Two features of the site are of particular interest. Firstly, it exhibits dramatic arch-shaped folding of the rocks. Secondly, the site has yielded many fossils, particularly at the transition between the limestone and the shales. These include fossilised corals and brachiopod shells (marine invertebrates) important in interpreting the palaeoecology of the Middle Devonian period.

At the western end of the cove there is a good example of landslip and rockfalls but please be careful when exploring and follow the safety guidance at the start of this booklet.

Facilities

Beach café, toilets.

Access

Foot: The South West Coast Path runs through the site, from Torquay Harbour follow Parkhill Road. **Train and Bus:** Main line train station nearby and bus services run from Exeter and Plymouth to Torquay. **Road:** The site lies east of Torquay Harbour and is accessed by the Meadfoot Sea Road. Parking is available. **Boat:** One of the best ways to view the geology of this coastline is by boat and cruises are available along this coast at Torquay, Paignton and Brixham Harbour.



For further information on this site, please view www.englishrivierageopark.org.uk or please call 01803 606035 or view www.devon.gov.uk/geo-DAD.pdf

19. Kents Cavern



Nearest town: Torquay

OS grid reference: SX 934641

Status: SSSI, Ancient Monument

Management: Kents Cavern Ltd.



Kents Cavern is fascinating for both its geology and human history. It boasts beautiful and spectacular geological formations and significant prehistoric finds, including flint hand-axes dating from over 450,000 years ago. Indeed, it is one of the oldest recognisable human occupation sites in Britain. The oldest human bone ever found in Britain was discovered in Kents Cavern, a jawbone dated at 37-40,000 years old. Scientific research is on-going to discover if the bone is from a Neanderthal or a modern human.

The caves are within the Devonian limestone and were formed by water erosion over millions of years. Interestingly, whilst the limestone is naturally white much of Kents Cavern appears reddish-brown due to the iron oxide contained in the material above (similar to the south Devon soil). Some of the most notable geological features are formations of calcium carbonate also known as calcite. These include impressive stalagmites (growing from the floor). Kents Cavern has yielded some important fossil remains including such remarkable creatures as sabre-toothed cat, cave bear, mammoth and woolly rhinoceros. Many of the larger bones clearly show the marks of hyena teeth.

Facilities

Restaurant, shop, licensed bar and guided tours.

Access

Foot: From the South West Coast Path leave the path near the Palace Hotel. **Bus:** Services run from Exeter to Wellswood. **Road:** Follow the A380 from Exeter to Torquay harbour and then follow the brown tourist signs.



© Kents Cavern Ltd

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For further information and details of opening times and admission charges visit www.kents-cavern.co.uk or call 01803 215136. Further geological information is available at www.englishriveragepark.org.uk and www.devon.gov.uk/geo-KEC.pdf

20. Hope's Nose to Walls Hill

Nearest town: Torquay

OS grid reference: SX 932654 – SX 947635

Status: SSSI

Management: Torbay Coast and Countryside Trust



This impressive stretch of coastline can be easily accessed from Torquay and demonstrates some important geological features.

The main rock here is Devonian limestone and this can be seen in some excellent exposures. Some of these display abundant collections of fossil animals, including well preserved corals - evidence of times when Torbay was located south of the equator and bathed in shallow tropical seas. Other notable features of the site, particularly on the eastern side of Hope's Nose, are a number of distinct mineral-rich veins. It is the only known location in Britain for the assemblage of minerals present, including native gold and rarities such as palladium (a metallic element that resembles platinum).

On the southern side of Hope's Nose, and also on the nearby Thatcher Rock, raised beaches can be seen about 6m above present day sea levels. These are very rich in fossil marine molluscs, with 17 species present at Hope's Nose, and no fewer than 43 species at Thatcher Rock. These beaches tell a story about past sea-level change and date from a warm interglacial period in the Ice Age when the seas were much higher than today.

A large fold can also be seen in the limestone at Hope's Nose which is the result of earth movement under great pressure caused by tectonic plate collision.

The coastline from Hope's Nose north to Walls Hill well demonstrates the connection between geology and wildlife and is of national importance for its limestone woodlands and species-rich grassland.

Facilities

There are a number of parking areas along the coastal section.

Access

Foot: The South West Coast path runs through the site. **Bus and Train:** There are regular services from Exeter to Torquay. **Road:** Follow the A380 from Exeter to Torquay. From Torquay Harbour follow Meadfoot Sea Rd to Ilsham Marine Drive. **Boat:** One of the best ways to view the geology of this coastline is from the sea and cruises are available from Torquay, Paignton and Brixham Harbour.



For further information and details of events on this site, please view www.englishrivierageopark.org.uk, www.countryside-trust.org.uk or please call 01803 606035. Also, further geological details are available at www.devon.gov.uk/geo-HWH.pdf

21. Dawlish Warren & Cliffs

Nearest town: Dawlish

OS grid reference: Warren - SX 985793; Cliffs - SX 977778

Status: LNR, SSSI, NNR, SAC, SPA

Management: Teignbridge District Council (the Warren)



Dawlish Warren is a fascinating place. This sand spit at the mouth of the Exe Estuary is not only of geological interest but is also a nationally important habitat for a wide variety of plants and animals. It also has a protective effect on the estuary and helps to prevent localised flooding.

Dawlish Warren is a rare 'double sand spit' with two dune ridges that, in the recent past, were separated by a tidal inlet. The two ridges can still be seen, most clearly from the meadow known as Greenland Lake. The Warren is also unusual because it is an acidic sand spit and is not derived from shell material.

Compared to most sites of geological interest, Dawlish Warren is very young – a mere 7000 years old! It was created by post glacial sea level rises. As might be imagined, a sand spit is not the most stable of structures and its continued presence relies on a balance between erosion on the one hand and the arrival of sediments that travel along the coastline in a north-easterly direction (longshore drift). The wind has also had a significant effect on the Warren, with sand dunes visible in the exposed areas facing the open sea. The more sheltered area behind the spit has developed an area of intertidal sand and mud that provides feeding grounds for wintering wildfowl and waders. The Warren continues to evolve and in recent decades storms and higher tides have resulted in an overall loss of sediment.

Nearby to the south-west can be seen the impressive Dawlish Cliffs. They show some of the finest exposures of Permian sands in Britain and



their red colouration is a striking feature of the coastline. Ancient winds piled up these sands upon what was a gravelly desert floor and you are, in effect, looking at fossilised sand dunes. The modern effect of wind erosion on these cliffs has produced some striking patterns and forms in the exposed sand.

Facilities

Nearby parking, shops and cafes. Cycling is not permitted within the reserve at Dawlish Warren, where dog restrictions also apply all year round.

Access

Train: Direct services from Exeter and Plymouth.

Bus: Regular bus services run to Dawlish Warren from Exeter. **Road:** Leave the M5 Motorway at junction 30 and follow signs for Dawlish along the A379.

For further information please view www.dawlish.gov.uk, www.devon.gov.uk/geo-DWW.pdf and www.devon.gov.uk/geo-DWC.pdf.

22. Orcombe Point to Lympstone

Nearest town: Exmouth

OS grid reference:

SY 256896 – SY 323913

Status: AONB, SSSI, SPA, WHS

Management: National Trust, East Devon District Council & private landowners



Orcombe Point marks the western gateway of the Jurassic Coast World Heritage Site and its oldest rocks, dating from the early Triassic period around 252 million years ago, can be seen here. The dramatic red mudstone and sandstone reveal evidence of a previous desert environment crossed with seasonal life-giving rivers similar to Namibia today. Rare plant fossils have been found here. Of more recent design is the Geoneedle unveiled by HRH the Prince of Wales in 2002 in celebration of the Jurassic Coast World Heritage Site.

Passing westward from Orcombe Point you come to the Maer Local Nature Reserve. This is an area of sand dunes which before the construction of the road along the seafront would have been a landward extension of the bigger dunes on the beach. This sand rests on a raised beach which is 8 to 10m above the present beach level.



© Sarah Firth

Low cliffs at the northern end of Lympstone show an exposure of a rock consisting of large angular pebbles, made from a variety of rock types including granite, sandstone, and volcanic rocks. This is known as the Exe Breccia (a word that literally means 'rubble') and is the result of torrential flash floods bringing material from mountainous ground to the west.

This stretch of coastline also offers terrific views of the Exe Estuary, a site of international importance for its wildlife.

Facilities

Toilets, cafés and car parking are available in Exmouth.

Access

Bicycle: Cycle routes from Exeter – Exmouth will be open mid 2008. **Bus & Train:** Frequent local services run from Exeter to Exmouth. **Road:** On the A376 to Exmouth, follow signs to the seafront. There is a car park in Lympstone opposite the Swan Inn within easy walking distance of Lympstone pier which is just south of the cliff section. **Foot:** From Lympstone to Exmouth follow the East Devon Way footpath and from Exmouth to Orcombe Point the path joins up with the South West Coast Path. Please be careful whilst exploring the coastline and refer to the safety notes at the start of this booklet.

Further information: please view www.jurassiccoast.com/index.jsp or <http://www.exe-estuary.org>. A copy of the Maer Local Nature Reserve leaflet can be viewed at www.eastdevon.gov.uk/cs-maerleaflet.pdf

23. Budleigh Salterton Cliffs and the Otter Estuary



Nearest town: Budleigh Salterton

OS grid reference: SY 055814

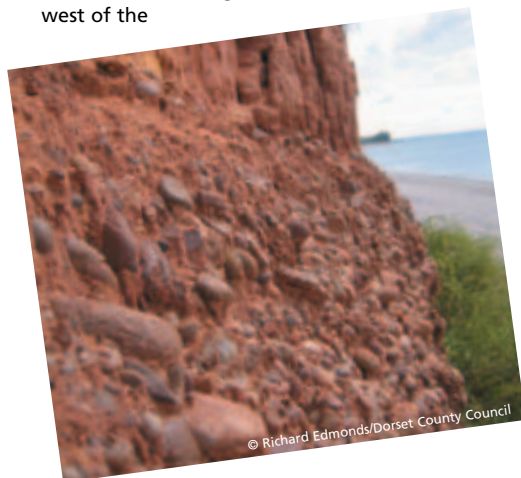
Status: AONB, SSSI, WHS

Management: East Devon Pebblebed Heaths Conservation Trust (Otter Estuary)



The cliffs in the western part of Budleigh Salterton expose the full thickness of the Lower Triassic Budleigh Salterton Pebble Beds. The Beds are made up of well-rounded pink, red and grey cobbles and pebbles that resulted from the erosion of 400 million year old quartzite outcrops lying to the south-west, possibly now under younger rocks in the English Channel or even Brittany. These were laid down as a coarse gravel in a large braided river which crossed a Triassic desert 246 million years ago. Over the years erosion processes have released the pebbles from the bed thus creating the present pebble beach. Some of these pebbles have been carried by the action of the sea as far east as Sussex and Kent.

The Budleigh Salterton Pebble Beds are overlain by red Otter Sandstone which is of mixed wind-blown and river origin and can be seen west of the



© Richard Edmonds/Dorset County Council

promenade and in low cliffs behind it. At Otterton Point, on the eastern side of the mouth of the Otter Estuary, this sandstone has yielded important fossil remains including 'the Devon rhynchosaur', an ancient reptile that has allowed these rocks to be dated to the Triassic period. The Otter Estuary is also important for its modern day wildlife.

Facilities

There are information boards, viewing platforms, toilets, shops, cafes, a tourist information centre and a car park. When walking along the coastline please take care and refer to the safety guidance at the start of this booklet.

Access

Foot: Access is via the South West Coast Path or along the beach from Budleigh Salterton.

Bicycle: There is an Exmouth to Budleigh Salterton cycle route. Easy access on the western side of the estuary. **Bus:** Buses run regularly from Exmouth and Sidmouth. **Train:** Train services run to Exmouth. **Road:** From Exeter, take the A376 to Exmouth and then go west along the B3178 to Budleigh. There is car parking at Budleigh Salterton.

For further information, please view www.jurassiccoast.com or www.devon.gov.uk/geo-BSC.pdf

24. Ladram Bay to Sidmouth

Nearest town: Sidmouth

OS grid reference: SY 096850 – SY121869

Status: AONB, SSSI, WHS

Management: The National Trust and Clinton Devon Estates



The views from Ladram Bay to Sidmouth are some of the most dramatic on the East Devon coastline. Both Ladram Bay and Sidmouth are situated on the Triassic Otter Sandstone. This is the same sandstone which, at depth, is an important oil reservoir at the Wytch Farm Oilfield near Poole.

Among the more impressive sights along this stretch of coast are the sea stacks at Ladram Bay. The sea hollowed out caves in the relatively soft Otter Sandstone and these, in time and with the further action of the sea, came to form arches of

Eastern Devon



© Richard Edmonds/Dorset County Council

rock separate from the main cliff. Eventually, these arches collapsed, leaving the stacks we see today. The base of the stacks is formed of a harder band of sandstone and this is preventing their complete destruction by the sea. Towards the south-west of the Bay can be seen some pale pipes in the sandstone, a visual echo through time of the roots of plants that managed to survive in the dry Triassic conditions. Within the cliffs below High Peak and Chit Rocks at Sidmouth a number of very rare fossils of Triassic fish, reptiles and amphibians have been found.

At Windgate Cliffs you can head inland to visit Peak Hill and Mutter's Moor. These sites overlay an interesting geology in their own right. For example, Peak Hill is underlain by flint gravel that was probably left behind following the solution of an original cover of chalk during the early Tertiary period. These sites also make a pleasing diversion for their wildlife and views, with areas of heath and woodland to be enjoyed.

Facilities

Toilets and cafés are available in Sidmouth.

Access

Please take care on the coastline and refer to the safety guidance at the start of this booklet.

Foot: One of the best ways to get to Ladram Bay is by following the South West Coast Path from either Budleigh Salterton or Sidmouth. **Bus:** regular services run between Budleigh Salterton

and Sidmouth. The Sidmouth Hopper runs to Peak Hill (summer service). **Road:** On the A3052, at Newton Poppleford, take the B3178 towards Budleigh Salterton and go through Colaton Raleigh. After one mile, take a left turn at the brick monument signposted Otterton and Ladram Bay. When in Otterton, simply follow the signs to Ladram Bay.



For further information on this site, please view www.jurassiccoast.com or www.devon.gov.uk/geo-LBS.pdf and www.devon.gov.uk/geo-PHM.pdf

25. Sidmouth to Beer Coast

Nearest towns: Sidmouth & Beer

OS grid reference: SY 130873 - SY 236895

Status: AONB, SSSI, SAC, WHS

Management: National Trust & private landowners



Between Sidmouth and Beer the geology is strongly influenced by a gentle easterly dip in the layers of the rocks that are present. The result is that as you travel east the visible rocks change from those of the Triassic Period (230 million years) to the more recent Cretaceous (70 million years ago). This reflects the unique 'walk through time' that can be experienced along the length of the Jurassic Coast World Heritage Site, of which this is a part.

Just east of Sidmouth are the Triassic Mercia Mudstones and these bring a distinctive red



© Sarah Firth

colour to the rocks. They were deposited in temporary lakes and rivers in a desert environment. These mudstones are then capped with yellow Upper Greensand and white Chalk (this from the younger Cretaceous Period; 'Creta' is Latin for 'chalk'). Both these rocks were laid down in a marine environment, the chalk mainly consisting of the skeletons and shells of countless numbers of organisms, most of them microscopic. As you move towards Beer the easterly dip increasingly brings the pale sands of the Upper Greensand and its overlying Chalk down to beach level and by Beer Head the entire cliff is taken up by these Cretaceous rocks.

All things being equal, you could expect to see Jurassic rocks lying above the older Triassic material and below the younger Cretaceous deposits. The Jurassic Period began about 206 million years ago. However, you will notice no reference above to Jurassic rocks between the Triassic mudstones and the Greensand and Chalk of the Cretaceous Period – they are missing from the site and have been eroded away. This kind of break in the geological story is known as an unconformity.

Facilities

There are car parks, toilets, restaurants, shops and pubs in Sidmouth, Branscombe and Beer.

Access

Foot: The South West Coast Path runs through this area. Please also refer to the safety guidance at the start of this booklet. **Bus:** The X53 Bus regularly operates in the area. **Road:** On the A376 to Exmouth, follow signs to the seafront.

Bicycle: There is an inland on-road signed cycle route between Sidmouth and Beer.

For details please view www.nationaltrust.org.uk, www.jurassiccoast.com and further geological information is available at www.devon.gov.uk/geo-SID.pdf

26. Beer Quarry Caves £

Nearest town: Beer

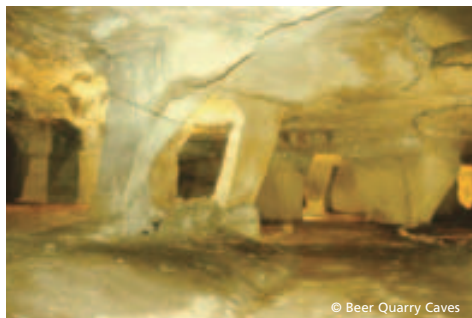
OS grid reference: SY 214895

Status: AONB, SSSI, SAC

Management: Beer Quarry Caves Ltd.



Beer Quarry Caves provide a fascinating insight into the geology of East Devon, where a unique limestone was formed on the seabed 92 million years ago from a mixture of pulverised shells, fine sand and clay. Beer Stone is ideally suited for fine detail carvings but hardens on exposure to the air and was used in the construction of 24 cathedrals including Exeter, Winchester and St Paul's, as well as Hampton Court and Windsor Castle.



© Beer Quarry Caves

Conducted tours of these vast underground caverns, which were started by the Romans and worked until the early 20th century, illustrate how the stone was quarried by candlelight with pick axes and saws, then transported on horse-drawn wagons and by barges which sailed from Beer beach. The Roman chambers (where the roof is supported by typical Roman arches and the walls bear tool marks) now house a small museum. The quarry provided a place of refuge for Catholics during times of persecution and a hiding place for contraband when Beer village was renowned for smuggling. It now provides a winter home to many species of hibernating bats.

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Facilities

Guided tours, extensive free parking, toilets and light refreshments. Open daily Monday before Easter to end October and at other times by prior arrangement.

Access

Foot: Accessible from the South West Coast Path.

Road: Follow brown and white tourist signs from A3052 (Sidmouth to Lyme Regis road) off the M5 junction 30 or signs from Beer and Seaton.

Bicycle: There are signed on-road cycle routes that run through and around Beer.



© Beer Quarry Caves

Further information:

www.beerquarrycaves.fsnet.co.uk
or call 01297 680282.



© Peter Wakely/Natural England

27. Axmouth to Lyme Regis Undercliffs

Nearest towns: Seaton & Lyme Regis

OS grid reference: SY 256896 –
SY 327912

Status: AONB, SSSI, NNR, SAC, WHS

Management: Natural England



This magnificent 304 hectare nature reserve managed by Natural England offers dramatic coastal scenery and is of international importance for its geological and geomorphological features and wildlife, which are well viewed from the beach or even better from a boat.

Travelling from Axmouth to Lyme Regis the rocks get younger, providing a rare opportunity to observe 'geological time'. In the west, near Axmouth, can be seen 235 million year old red mudstones deposited during the arid Triassic Period; the grey bands are the remains of old salt lakes. Heading east, these are replaced by 195 million year old grey mudstones and limestones of the Lias (the oldest part of the Jurassic Period). These Jurassic sediments were laid down in a warm, shallow tropical sea and can yield the fossils of marine animals. Ammonites are not uncommon and past discoveries have included marine reptiles such as ichthyosaurs and plesiosaurs. Please leave all in situ fossils for

others to enjoy. In places, these rocks are overlain by the more recent sandstones, clays and chalk of the Cretaceous Period, laid down in marine conditions about 70 million years ago.

Extensive and dramatic landslides have also heavily influenced the coastline as you see it today and it is not unusual for the more recent Cretaceous rocks to have slipped down to beach level.

Facilities

The nearest toilet and refreshment facilities are in Lyme Regis and Seaton.

Access

Foot: The South West Coast Path runs through this 7 mile long reserve but it does not provide access to the beach, which may be gained at either Axmouth or Lyme Regis (hazards here include rock fall and high tides). **Bus and train:** There are regular bus services to Seaton and Lyme Regis, including the 'Jurassic Bus' (X53), and bus links to the train station at Axminster. **Road:** There are public car parks at both Seaton and Lyme Regis. **Boat:** There are trips from Beer and Lyme Regis.

For further information on this site, please view www.jurassiccoast.com, www.naturalengland.org.uk or www.devon.gov.uk/geo-ALU.pdf

28. Exeter City Walls & Cathedral



Nearest City: Exeter

OS grid reference (Cathedral): SX 921925

Status: Listed buildings / Scheduled Ancient Monument



Management: Exeter City Council, Chapter of Exeter Cathedral & private landowners

Exeter City Council

Over 70% of the wall that once protected Exeter still remains and reveals a lot about the geology of the local area. Work began on the wall about 1800 years ago by the Romans and the following centuries saw many alterations and repairs, generally using whatever material was to be found

nearby. A walk along the walls will reveal a range of different rock types.

The early Roman construction makes use of purplish grey volcanic lava of Permian age (known as 'trap'), which was partly quarried nearby from the site of the Rougemont Castle. In the Middle Ages repairers used red sandstone or Heavitree Breccia (Permian, again), another stone found locally in Exeter. Local slates and white sandstone can also be seen; possibly even stone left over from the building of the Cathedral was used.

Exeter Cathedral is magnificent and some have claimed that it possesses the most varied geology of any British cathedral. Materials from over 20 different quarries, many of them local, were used in its construction.

The outer and inner Cathedral walls are made of Salcombe Stone, a sandstone quarried from Salcombe Regis in east Devon. Between these walls is a loose filling of the same volcanic trap used in the construction of the City walls. Mines in the chalk at Beer, also on the east coast of Devon, were worked to provide stone for use in some of the Cathedral's sculptures, as can be seen on the impressive image screen at the front of the building. Further local geology can be seen inside the Cathedral. For example, the pillars supporting the Pateson Pulpit are made of a Devonian limestone that can take a polish and which has been deformed by earth movements such that some of the corals within it appear elongated. It can be found at a number of sites in South West Devon.



© Sarah Firth

Eastern Devon

Facilities

Cathedral: Tours available; shop and café on site. Special tours can be arranged by contacting the visitors office. Toilets available for Cathedral visitors. **City Walls:** information panels have been laid along the walls to highlight the key events that have affected the wall and the people of Exeter. For children there are quizzes and puzzles to solve along the way so bring paper and a pencil with you!

Access

Foot: The Cathedral is open to visitors at set hours. Free guided tours take place from March to October. The City Walls are accessible all year round. **Train and Bus:** Located in the city centre the Cathedral is easily accessed by sustainable transport. Buses are regular and the city is serviced by Exeter St David's and Central Train stations which are just a short walk away from the cathedral and the city walls. **Bicycle:** There are many cycle routes in and around Exeter to the Cathedral. **Road:** Follow the M5 to Exeter.

For further information on the Cathedral please view www.exeter-cathedral.org.uk or call 01392 285 983. For further information on the city walls, please view www.exeter.gov.uk. More information on Exeter's geology can be found in Exeter in Stone, an urban geology by Jane Dove and published by Thematic Trails.



© Sue Satchell

29. Brampford Speke

Nearest City: Exeter

OS grid reference: SX 930986

Status: SSSI

Management: Private landowner

This site is an ideal and very pleasant location to see the River Exe as it snakes its way through the Exe Valley, and well demonstrates how a typical meandering river can effect the development of a floodplain. Here, processes of erosion and deposition are causing the River Exe to cut through the local Permian sandstones.

The river is eroding the banks on the outside bends of the meanders. On the inside bends the river has less force and so deposits sediment, particularly heavier materials such as gravel. By this action the river migrates and lays down a layer of mainly gravelly sediment behind it. At times of very high flow the river spills over its banks and spreads over the floodplain depositing sand and loam over the coarser sediments left by the meandering channel.

Facilities

There is limited parking for cars and minibuses in Brampford Speke. Toilets and refreshments are available in Brampford Speke. School parties are welcome by arrangement, please contact 01392 841785.



Access

Foot: The Exe Valley Way leads across the site and a public footpath leads on to Stoke Canon.

Bus: There are a few buses each day from Exeter.

Road: This area can be reached by taking the A377 north from Exeter in the direction of Crediton and following a minor road to the village of Brampford Speke.

For further information on this site, please view:
www.devon.gov.uk/geo-BRS.pdf

30. Killerton Park

Nearest City: Exeter

OS grid reference: SS 973007

Status: SSSI

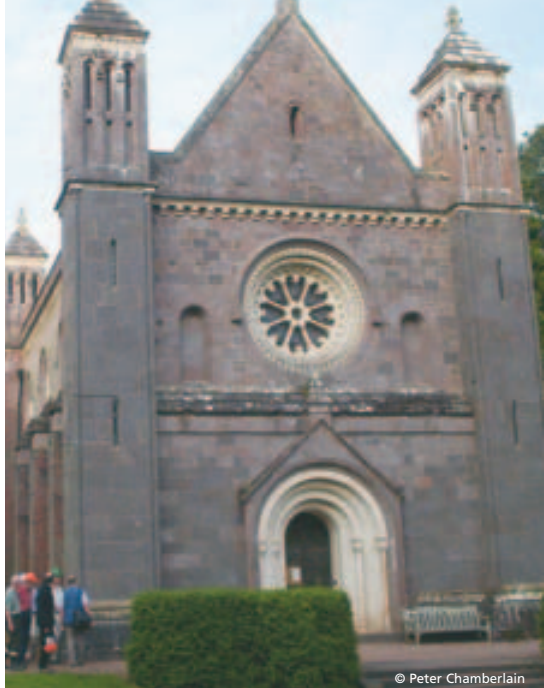
Management: National Trust



The area around Killerton shows signs of having experienced high levels of volcanic activity about 285 million years ago. Evidence of this can be seen all around the area from the natural landscape to the local buildings.

The high ground behind Killerton House is made up of purplish tinged basalt lava. This lava poured out on to a rocky and sandy desert floor and probably came up through a series of cracks in the ground rather than through a single vent.

The lava has been quarried for many years providing the material for local buildings such as Killerton Chapel.



© Peter Chamberlain

Killerton Chapel

Facilities

There is a shop, refreshments, guided tours, a picnic area, events and routes for walking and cycling available at the site.

Access

Road: From Exeter follow the Cullompton road (B318); from M5 northbound, exit J30 via Pinhoe and Broadclyst; from M5 southbound, exit J28.

Bus: Regular services from Exeter to Silvertown Turn and a 15 min walk to Killerton House.

Bicycle: National Cycle Network 52 runs from Pinhoe to Killerton House.

For more information about Killerton House please view www.nationaltrust.org.uk and further geological information is available at www.devon.gov.uk/geo-KIL.pdf

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31. Lynmouth area

Nearest town: Lynton

OS grid reference: SS723495

Status: SSSI, National Park

Management: National Trust, Exmoor National Park & private landowners



This area on the beautiful coast of Exmoor National Park is home to a number of fascinating geological features.

To the west of Lynton is the famous Valley of the Rocks. The site has excellent exposures of the Lynton Beds that are rich in fossils and are some of the oldest Devonian rocks in the north Devon – Somerset area. However, it is perhaps the topography of the site that is most dramatic, with many classic landforms on show. These include a dry valley and a number of periglacial features demonstrating the effects of the freezing temperatures present here during the Ice Age when glaciers reached as far south as the north Devon coast.

To the east, at Lynmouth, a large boulder fan can be seen extending into the Bristol Channel from the mouth of the East and West Lyn rivers. This bears witness to major flooding over thousands of years and in particular to the disaster of August 1952 following a period of very heavy

rainfall. Water flowed in sheets over the surrounding open moors and the resulting volume of water - estimated to be the equivalent of three months discharge of the River Thames - moved over 50,000 tonnes of boulders, some of more than 10 tonnes each. Many of these boulders can still be seen in the river beds and other features associated with the flood, such as boulder field deposits, can still be observed in the upper valleys.

Facilities

Lynmouth and Lynton are popular tourist spots and a range of facilities are available. Information on the floods can be found in the Power of Water Exhibition at Glen Lyn Gorge.

Access

Foot: The South West Coast Path runs through Lynmouth and Lynton. **Bus:** A number of services are available from nearby towns, including Barnstaple, Ilfracombe and Combe Martin. **Road:** Follow the A399 from Ilfracombe and Combe Martin, or north from the A361. Then take the A39 towards Lynton and Lynmouth.

For further details on the geology of this area please view www.devon.gov.uk/geo-WEC.pdf and www.devon.gov.uk/geo-RLL.pdf.

32. Combe Martin Bay to Hele Bay

Nearest town: Ilfracombe

OS grid reference: SS 536479 – SS 586484

Status: VMCA, AONB, SSSI, National Park

Management: National Trust, private landowners and Combe Martin Parish Council.



Commencing within Exmoor National Park, this beautiful stretch of coastline reveals some dramatic geology of the Devonian age. There are a number of very good exposures of sandstones and mudstones, and within these can be found a



number of limestone bands, especially prominent at Rillage. These bands of limestone contain fossils, including corals, fish fragments and brachiopods (marine invertebrates) suggesting they were laid down in a shallow marine environment.

A particularly impressive feature of the coastline is the large number of folds that can be seen in the rock. They clearly indicate the tremendous pressures that were once at play here and are the result of the tectonic plate collision. Some of the bedding dips at angles of between 35° and 40° but other examples are almost vertical.

Combe Martin once mined silver for the Crown, as well as lead; iron ore was also worked. Part of a mine adit can be seen in the cliffs on the north-eastern side of the beach. Lime burning was also practised, Combe Martin having more kilns than any other north Devon parish.

Facilities

Parking is available at both Combe Martin Bay and Hele Bay. There is a small geology display at the Tourist Information Centre, near Kiln Car Park. There is also a museum in Combe Martin.

Access

Foot: There is access to both beaches (Hele Bay and Combe Martin Bay) as well as access to smaller secluded beaches such as Broadstrand and Watermouth. However, there is no access to much of the foreshore along the coastline and the dangers of falling from the cliff or getting cut off by incoming tides are high. The site can be best viewed from the beaches at low tide or from the South West Coast Path. Please also refer to the safety guidance at the start of this booklet. **Road:** Take the A399 from Ilfracombe and follow signs to Combe Martin Bay. **Bus:** There are regular services between Ilfracombe and Combe Martin and Hele Bay. **Bicycle:** There are signed on-road cycle routes between Ilfracombe, Combe Martin Bay and Hele Bay.

For further information please view www.devon.gov.uk/geo-HSC.pdf

33. Woolacombe to Ilfracombe

Nearest town: Ilfracombe

OS grid reference: SS 457439 – SS 511476

Status: VMCA, AONB, SSSI

Management: National Trust & private landowners



Devon's coastline shows some spectacular geology and this is certainly true between Woolacombe to Ilfracombe.

Woolacombe itself is home to an impressive series of sand dunes. A short way to the north is Barricane Beach. Here, slates deposited in a shallow marine environment during the Upper Devonian are well exposed and are very rich in fossils.

From here the South West Coast Path passes through the wonderful Morte Point, with cliffs of slate rising from 50m to 100m, and on through some of the most spectacular of Devon's coastline to Ilfracombe.

The same tremendous forces that have caused rocks to be heaved up and folded in other parts of South West England caused similar deformation along this coast. The rocks were caught between two converging tectonic plates, were compressed and their minerals re-crystallised and re-orientated. This resulted in the more mud-rich rocks developing the ability to easily split (this is known as 'slaty cleavage').

Good examples of slaty cleavage can be seen with care from the cliffs at Windy Cove on Morte Point and further along in the cliffs of Tunnel Beach at Ilfracombe. As the name suggests, Tunnel Beach is reached through a tunnel which branches to the left and right. The left branch leads to 'Gent's Beach' whilst the right branch takes you to 'Lady's Beach', a reminder of the days when trips to the seaside were undertaken with a sense of decorum and modesty in mind.

Facilities

The Devon Wildlife Trust organises guided rock pool adventures and other organised events. There are mini-marine centres at Ilfracombe Museum, Morte-hoe Heritage Centre and Braunton Countryside Centre. The National Trust organises many guided walks and events,

Northern Devon and Exmoor



including tractor/trailer rides to see the seals at Morte Point. In Ilfracombe there is an Aquarium. There is a small geology display at the Morteheo Heritage Centre/Museum.

Access

Foot: The South West Coast Path runs the entire length of the North Devon VMCA. Please take care and refer to the safety guidance at the start of this booklet. **Road:** From Barnstaple follow the A361 to Ilfracombe (Woolacombe is a turning off the A361 onto the B3343). **Bus:** There is a regular service from Barnstaple to Ilfracombe and from Barnstaple to Woolacombe (with a change in Trimstone). **Bicycle:** There is a National Cycle Route (on and off road) inland between Woolacombe and Ilfracombe connecting to Barnstaple.

To find out more about the North Devon VMCA please telephone 01271 812777 or view www.devonwildlifetrust.org. Also, www.nationaltrust.org.uk.

34. Lundy £

Nearest towns: Bideford & Ilfracombe

OS grid reference: SS 135460

Status: SSSI, MNR, SAC

Management: The Landmark Trust (owned by the National Trust)

Lundy is an island in the Bristol Channel, lying only 18 kilometres from mainland Devon. It is just five and a half kilometres long and less than a kilometre wide, and has been designated

England's first Marine Nature Reserve. A visit to the island is a unique and worthwhile experience.

Some of the rocks that make up Lundy began to form 380 million years ago when shallow marine muds were laid down and then compressed and heated to form slates. These 'Morte Slates' crop out in the extreme south-east of the island near the quay. However, most of Lundy is composed of granite, though not the same 280 million year old granite seen at Dartmoor. Instead it is a mere 60 million years old. It was injected into the Morte Slates during a period of volcanic activity connected with the opening of the Atlantic Ocean.



Unlike mainland Devon, Lundy was covered by glaciers during the Ice Age and this had a profound effect upon the shape of the island. It originally took the form of a cone but the ice decapitated this, leaving the flat topped island we see today.

Facilities

Open all year. The ferry operates from late March to late October and a helicopter service operates through the winter months for staying visitors. A Landrover can be provided at the jetty for disabled visitors. There is a pub and shop, and accommodation (book in advance).

Access

Ferry: From Bideford or Ilfracombe. **Train and Bus:** Frequent services from Barnstaple train station to Bideford or Ilfracombe.

For further details please view
www.lundyisland.co.uk, or
www.nationaltrust.org.uk.

35. Baggy Point to Saunton

Nearest town: Barnstaple

OS grid reference: SS 445407 to
SS 446378

Status: VMCA, AONB, SSSI

Management: National Trust
& private landowners



© Sarah Firth

The coastline from Baggy Point south to Saunton Sands is a magnificent sight. The rocks are about 370 million years old (Devonian) and include a wide range of sedimentary rock types such as sandstones, shales, slates and limestones. The bulk of these were probably laid down in shallow marine or brackish waters. Today, the effect is impressive and the coastline boasts rugged cliffs rising in places to 60m. There is evidence of the past stresses and pressures that have been at work here, with dramatic folding and fractures in the rocks being quite common.

Of particular interest are the signs of Ice Age activity in the area. Raised platforms cut by wave action at times of high sea levels are now home to a number of large boulders transported here by ice. Some of these may have been carried considerable distances. The most famous, the Saunton Pink Granite (SS 44013787), weighs in at 12 tonnes and is likely to have come all the way from the north-west highlands of Scotland. This



can be viewed from the foreshore but if visiting the erratic please check the incoming tide as there is the risk of being cut off from the beach. See safety guidance at the front of this booklet.

Facilities

There are various car parks which are easily accessible. For access to Baggy Point use the National Trust car park at Croyde Bay, then follow the South West Coast Path (easy access path to Baggy Point). There are also car parks at Saunton Sands and Downend near Croyde. Saunton Sands has a restaurant and both Saunton Sands and Downend have toilets and a small shop.

Access

Foot: From Croyde Bay the site can be accessed from the South West Coast Path. **Bus:** There are regular buses from Barnstaple to Saunton. **Road:** The site is located approximately 8 miles along the B3231 from Barnstaple (A361).

For further information on this site please view www.devon.gov.uk/geo-SAU.pdf.

36. Braunton Burrows

Nearest towns: Braunton and Barnstaple

OS grid reference: SS 450350

Status: AONB, SSSI, SAC, UNESCO Biosphere Reserve

Management: Christie Estates
& Ministry of Defence



Braunton Burrows is a dramatic series of sand dunes located at the mouth of the Taw-Torridge Estuary and is one of the most important examples of its type in Britain. Few other dune systems are less affected by underlying geology and afforestation, making this a key site for the study of coastal geomorphology.

Northern Devon and Exmoor



© Neville Stanikk/North Devon AONB



© Craig Dixon

At over 5km long and 1.5km wide, the sheer scale of Braunton Burrows is impressive. Towards the centre of the site some of the dunes reach up to 30m in height and are amongst the largest in the country. Smaller foredunes, flooded slacks and past evidence of major sand blowouts can also be seen.

The dunes are of international importance for their wildlife, including a number of rarities, and form the core of a Biosphere Reserve.

Facilities

Generally open to the public but areas are occasionally used for military training, including the firing of blank rounds, and visitors must observe any advice given by the range supervisors.

Access

Foot: The South West Coast Path runs just inland of the dunes and links with the Tarka Trail (and Braunton and Barnstaple). **Bus and train:** There are bus links to Barnstaple and nearby Braunton. Barnstaple has a main line train station. **Cycle:** The Tarka Trail provides an excellent National Cycle Network route from Barnstaple to Braunton along the Taw Torridge Estuary. **Road:** A number of small roads lead to the Burrows from nearby Braunton. Car parking is available off Sandy Lane.

For further information on this site, please view www.devon.gov.uk. Geological details are at www.devon.gov.uk/geo-BRB.pdf.

37. Westward Ho! Cliffs and Northam Burrows

Nearest town: Bideford

OS grid reference: SS 420291 - 434296

(Westward Ho! Cliffs)

SS 445305 (Northam Burrows)

Status: AONB, SSSI

Management: Torridge District Council & private landowners



The Westward Ho! cliffs provide a good section of a raised beach platform well above the level of the present beach. This platform and the deposits upon it are very important because they provide evidence of glacier ice reaching the South West peninsula. For example, flint and granite erratics (stones transported by an ice sheet or glacier) are present, as is a deposit of angular rock debris of the kind that flows down slopes during freeze/ thaw conditions in the vicinity of ice.

Remarkably, there is a submerged forest amid peat deposits that can be seen around the low water mark at the eastern end of the site (SS 432296) off Westward Ho! Slipway at the southern end of Westward Ho! beach. This provides evidence of sea level rise during the Holocene Period and represents the swamping of a coastal forest by the sea about 6000 years ago.

The cliffs of Westward Ho! directly adjoin Northam Burrows Country Park. A grassy coastal

plain with salt marsh and sand dunes, this site is of considerable importance for both its wildlife and geology. Of particular note is its famous shingle ridge/spit formed by longshore drift with pebbles coming from further around Bideford Bay, which features some unusually large pebbles. These are made of a hard, fine-grained sandstone that outcrops in the cliffs to the south. When exploring the coastline please take care and refer to the safety guidance at the start of this booklet.

Facilities

Visitor centre and toilets are available at Northam Burrows.

Access

Foot: The South West Coast Path is readily accessible. **Bus:** There are bus links between Barnstaple, Bideford and Northam. **Road:** From the A39 from Barnstaple take B3236 through Northam and follow signs to Westward Ho!. Parking is available.



For opening times of the visitors centre please call 01237 479708 or view www.torridge.gov.uk. Further detail on the geology is available at www.devon.gov.uk/geo-NRB.pdf and www.devon.gov.uk/geo-WHC.pdf

38. Coddan Hill Viewpoint

Nearest town: Barnstaple

OS grid reference: SS 582296

Management: Private landowner

Coddan Hill provides an excellent vantage point from which to see the surrounding features in the landscape that are related to the underlying geology. Rising to over 190 metres, there are views of both the granite massif of Dartmoor, to the south, and the sandstone and shale landscape of Exmoor to the north.



© Nick Steenman-Clark, Devon County Council

Perhaps the most impressive feature of the landscape, however, is the series of 'whale-backed' hills (of which Coddan Hill is a fine example) which stretch west to east across the landscape and are visible as far as Swimbridge. They are the dramatic result of Earth movements of tremendous force resulting from the collision of tectonic plates.

Below and about 1.5km to the north of Coddan Hill can be seen Venn Quarry, where sandstone has traditionally been worked to provide stone chippings with a high skid resistance for the top surface of roads.

On the summit of Coddan Hill, towards its eastern end, there is a nationally important 'bowl barrow' with a surrounding ditch believed to date from the Bronze Age.

A small disused quarry [SS 569297] at the western end of Coddan Hill near Coddan Hill Cross provides a good, accessible exposure of the Coddan Hill Chert Formation – the limestone and chert of the Lower Carboniferous period that dominates the local geology.

Facilities

There is permissive access for horse riders, cyclists, and walkers. Grazing has been reintroduced so dogs need to be kept under tight control near livestock and gates need to be left as they are found. Some facilities are available in the nearby village of Bishop's Tawton. There are two car parking areas; one is south of the site opposite Horswell and the other is south east of the site opposite Hayne.



Northern Devon and Exmoor

Access

Foot: There are a number of footpaths that give access to the site and Codden Hill is just a short walk away from Bishops Tawton. **Train:** Regular train services are available to Barnstaple. **Bus:** There are regular bus services that run through Bishops Tawton from Barnstaple. **Road:** Bishops Tawton is situated to the east of the A377, 1 kilometre south of Barnstaple.

39. Hartland Point to Hartland Quay

Nearest town: Hartland

OS grid reference: SS 230277 – SS 222247

Status: AONB, SSSI, SAC.

Management: Private landowners

Lying within North Devon Area of Outstanding Natural Beauty, this stretch of coastline is one of the most dramatic in the British Isles. Breathtaking coastal scenery and wonderful cliff top walks are all to be found.

Here in the cliffs and foreshore you can view spectacular evidence of geological events which took place over 300 million years ago. The rocks are sandstones and mudstones that were laid down around 320 million years ago in what was then a brackish sea. Of particular interest are the striking patterns that can be seen in the faces of the cliffs. These tell a dramatic story of ancient forces that have helped to shape the Earth as we see it today.

About 300 million years ago, during a period of tectonic plate collision, tremendous pressure was exerted on the rocks of South West England. So powerful were these forces that the rocks were actually compressed like a concertina, producing a range of spectacular folds and faults that are visible today. These can be clearly seen in the cliffs to the north of Hartland Quay and a walk along the cliff top towards Hartland Point provides good views (if the tide is out) of the complex patterns of sandstone ribs produced on the foreshore by the folding.



© Pat Doody/Natural England

Looking south from the Quay's car park you can see a hanging valley and abandoned alluvial tract of the Milford Water. The truncated valley bottom can be seen clearly.

Facilities

There is a small museum, car parking, shops and a hotel (with public bar and restaurant) at Hartland Quay. There is a car park and a refreshment kiosk (open from Easter to the end of September) in Hartland Point. (Please report any interesting geological finds to the kiosk.)

Access

Foot: The South West Coast Path runs along the site giving easy access to the area. Main access to the foreshore is at Hartland Quay, although there is limited access at Spekes Mill, Blackpool Mill and Blegberry Beach. There are high cliffs and dangers of being cut off by the incoming tide. There is also little or no sand here so walking is difficult. The walk from Hartland to Hartland Quay is about 5km (some of the walk is on-road so care should be taken, especially on the roads around Stoke which have no footpaths). Please refer to the safety guidance at the start of this booklet. **Road:** Take the A39 Bude to Bideford Road and Hartland Point/Hartland Quay can be accessed by a series of country roads. **Bus:** There is a regular service between Bideford and Hartland but it would include a walk to Hartland Quay.

For further information on this site, please view www.northdevon-aonb.org.uk or call Bideford Tourist Information Centre on 01237 421853.



40. Barley Grove and Torrington Common

Nearest town: Great Torrington

OS grid reference: SS 496189

Management: Torrington Common Conservators & Torridge District Council.



The beauty of this site is its views. Standing at the viewpoint on Great Torrington Common you can look south over the valley of the River Torridge. Evidence of how the river has shaped the physical structure of the valley can be clearly seen.

You will see the river curve in from your left to run along the bottom of the Common. Look at the inside of the curve and the slope rising up from the river. You will notice a series of terraces underlain by gravels. These terraces represent the past action of the river (both erosion and deposition) as it has progressively cut down into the landscape.

Turning your attention to the Common below the viewpoint, you will be able to observe from some of the footpaths that there are several exposures of sandstones, siltstones and shales that are not normally easy to see. These were formed in deep water during the Upper Carboniferous (the same time that coal was being laid down in South Wales).

The rocks, comprising sandstones with interbedded shale and siltstone, can best be seen along 'Sliding Rock Path'. The bedding dips south and some quartz veining occurs.



© Torrington Common Conservators

Facilities

Public facilities and refreshments are available in Great Torrington.

Access

Foot: Public footpaths run across the Common.

Cycle: National Cycle Route 3 (the Tarka Trail) runs nearby. **Road:** Coming from the north on the M5 take J27 to the A361 to Barnstaple, then the A39 towards Bideford, then turn onto the B3232 to Great Torrington. Parking is available at the Barley Grove car park. **Bus:** There are regular buses from Bideford and Barnstaple to Great Torrington.

A diagram illustrating the river terrace levels is available on Devon County Council's website: www.devon.gov.uk/geo-BAG.pdf



Great Places to Stay

There is a wide range of accommodation in Devon. Delightful hotels on the coast or in the country, cosy country pubs, idyllic guesthouses and farms, ideal for family holidays. You will discover some wonderful and luxurious self-catering accommodation as well as relaxing holiday parks, camping and caravanning ... all ideal for that perfect break, all year round.

**Need more information
or want to make a booking?**

For information on visiting Devon
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Be a responsible visitor!

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Devon has the most fantastic natural environment and we all want it to stay that way.

Why not leave the car behind and explore Devon by foot, by bike or even by canoe?! Much of Devon's coast and countryside is accessible by public transport and it can be great fun! Why not Discover Devon Differently and see the Jurassic Coast, England's first natural World Heritage Site, from the top of a double-decker or enjoy the spectacular birdlife on the Exe Estuary from a ride on the Avocet Line?

Visit environmentally responsible attractions and indulge in some of the finest local food and drink on offer.



Come and explore!

More and more people are realising that taking the bus or train is an easy, convenient, fun alternative to worrying about driving along narrow, unfamiliar country roads and finding somewhere suitable to leave the car.

Devon is blessed with a very mild climate. **Spring** arrives early with daffodils and bluebells filling many of the woodlands and delicate yellow primroses, the County flower, carpeting the banks of the lanes.

The **summer** lingers for longer in Devon. It can be well into September before any misty mornings herald the start of **autumn**, a season of rich colours that also lends itself to discovering the countryside on foot.

Winter can be an appealing season to explore Devon's countryside too. Walkers can wrap up warm and take leisurely lunch stops relaxing in front of a warming log fire!

Be a Green Visitor

1. Do not disturb any livestock, keep your dog under close control leave all gates as you find them.
2. Take your litter home with you and recycle it if possible.
3. Do not disturb wild animals, birds or flowers.
4. Whether you are walking, cycling or driving, take special care on country roads.
5. If possible, leave your car at home and take the bus or train.
6. Buy locally produced goods, including food and souvenirs.
7. Support local shops, garages and other local services.

If you enjoy Devon's coast and countryside . . .

Why not pick up one of our free booklets at
Tourist Information Centres across Devon or
visit www.devon.gov.uk



For visitor information including accommodation availability visit
www.visitdevon.co.uk

If you need this in a different format
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Published by Devon County Council, County Hall, Exeter EX2 4QD. Tel: 01392 382000
February 2013. ISBN: 1-85522-873-4

Devon
County Council 