7th International Conference on UNESCO Global Geoparks
27th - 30th September 2016
ENGLISH RIVIERA UNESCO GLOBAL GEOPARK

United Nations Educational, Scientific and Cultural Organization

Under the patronage of **UNESCO**

Field Trip Guide

With thanks to our sponsors:

Contents

General Information

TOUR NUMBERS

Geopark Rocks: – T1, T2, T3, T4

Geopark Stories: – T5, T6, T7

Overground, Underground and Cruise (Torquay Cruise): – T8, T9, T10, T11

Overground, Underground and Cruise (Brixham Cruise): – T12, T13, T14, T15

Culture, Creativity and Community: – T16, T17, T18

Meeting point and tour departure times

All tours will depart from the Riviera International Conference Centre. However please note that departure times for the tours differ.

Please check your tour departure time in the table below and ensure that you arrive at the conference centre at least 20 minutes before your departure time.

TOUR DEPARTURE TIMES

Geopark Rocks:		Geopark Stories:		Overground, Underground and Cruise:		Culture, Creativity and Community:	
T1	08:15	T5	08:30	T8	08:45	T16	09:15
T2	08:15	T6	09:00	T9	09:15	T17	09:15
T3	08:30	T7	08:15	T10	08:45	T18	08:45
T4	08:45			T11	09:00		
				T12	08:15		
				T13	08:15		
				T14	09:15		
				T15	08:45		

Please arrive at the conference centre at least 20 minutes before your departure time.

Weather in September

The weather in the English Riviera in late September can be changeable and range from brilliant sunshine to rain, wind or low mist. Depending on where you have travelled from we are sure that some delegates will find it warm whilst others will find our temperature really quite cold.

Averages for Torbay in September:
Temperature – 15°C, 58°F
Low Temperature – 11°C, 52°F
High Temperature – 18°C, 65°F
Sunshine – 7 Hours
Rainfall – 18 mm
Rainfall – 11 days
Sea temperature – 16°C, 61°F

Clothing and footwear

For your comfort please ensure that you wear comfortable layered clothing and bring waterproofs.

Footwear should be suitable for walking and scrambling and therefore must have a decent tread. Anyone wearing smooth soled shoes or those that are deemed unsuitable by the leaders of the trips will be prevented from participating in certain parts of the field trips.

Lunch and refreshments

A packed lunch will be waiting on the coach for you and all tours have both a morning and afternoon refreshments provided.

Our Geo Time Spiral

Devonian

This is the time when our grey limestone rocks were formed in tropical seas south of the Equator. When creatures that lived there died they sank to the sea floor and layer upon layer they were changed into rock.

Devonian coral fossils

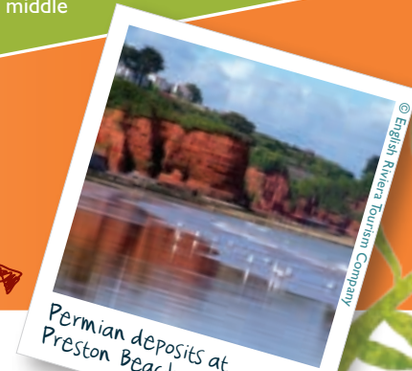
Carboniferous

In the time when giant dragonflies took to the air our limestone rocks were folded, crumpled and crushed as they were caught in the middle of a collision of continents.

Folds in the limestone rock

Permian

All of our red rocks were formed during this time in a desert, roughly were the Saraha desert is today.



Permian deposits at Preston Beach

Quaternary

A time when mammoth, wooly rhinoceroses and early man roamed here.

Human jawbone discovered in Kents Cavern is the oldest evidence of modern humans in north west Europe

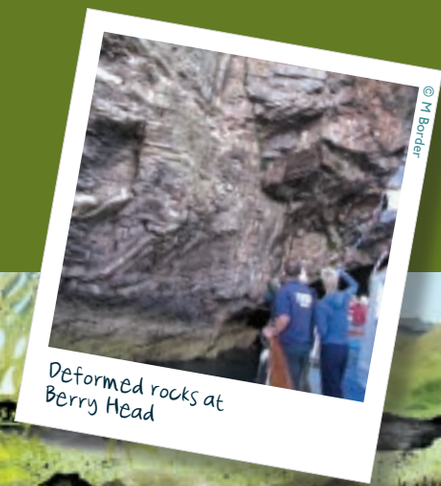
Introduction to the Geology of the English Riviera UNESCO Global Geopark

The spectacular geological tale that lies behind this dramatic and beautiful landscape reveals incredible stories about our Earth's distant past.

It begins, in an environment south of the equator, somewhat similar to the Caribbean, when our oldest rocks were formed on the southern edge of Laurussia in the Rheic ocean. Rich in fossils, the Marine Devonian Limestone reveals a stromatoporoid reef environment and a wealth of life now long extinct such as trilobites, goniatites and crinoids that were occasionally blanketed in ash by volcanic activity. Recognition of the fossil fauna found at sites such as Lummaton Quarry, by the eminent Victorian geologists, Sir Henry de la Beche, Adam Sedgwick and Sir Roderick Murchison, made an important contribution to the understanding of what was happening to the Earth around 416-359 million years ago and led to the naming of the Devonian period of geological time.

Marine Devonian Fossils at Hopes Nose

Shunted northwards by plate tectonics, the limestone, which was later to play such an important role in helping to settle the great "Devonian Controversy", provides fantastic physical evidence of the huge geological forces at work when it was caught in the midst of the collision between Laurussia and Gondwana at the birth of the super continent Pangaea. Despite living in what could be considered a geologically stable part of the world, the incredible Variscan deformation of the limestone, easily visible in the majority of exposures along the coast, bears witness to, and helps the public understand, the sheer scale and power of the Earth.



Deformed rocks at Berry Head

By the Permian period, the deformed limestone rocks were landlocked and exposed to erosion in an extreme desert environment. It is here in the heartland of Pangaea, that extensional cracks and fissures rapidly filled with aeolian desert sands whilst occasional but violent storms caused flash floods and fluvial deposition. Groundwater oxidised the iron within the sediments explaining the deep red colour of the rocks and of the area's classically recognisable rich red soil. Later, movement of different suites of fluids - rich in minerals - led to the formation of deposits of iron ore in the Brixham area and to the formation of internationally rare minerals, some new to science, at Hope's Nose.

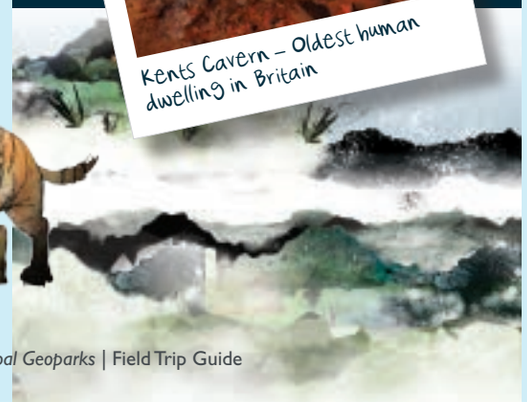
Permian deposits at Roundham Head

Introduction to the Geology of the English Riviera UNESCO Global Geopark ...

Yet this is by no means the end of our story. More recently, during the last 2.6 million years, having moved close to its present latitude, the area has been subjected to repeated glacial and interglacial periods. Evidence of the sequences of past climate change are rich in the form of raised beaches along the coastline but are particularly impressive within the depths of the extensive cave systems that were carved out by rainwater and streams.

During the ice ages, lower sea levels allowed both animals and early man to walk freely across what is now the English Channel and it is at this point that the importance of Kents Cavern, a nationally protected Scheduled Ancient Monument site, shines. It is here that an incredible record of human activity covering all three stages of the Palaeolithic can be found stretching back 500,000 years. Artefacts and evidence meticulously excavated were nestled amongst long extinct animals which fundamentally challenged the religious teaching and the antiquity of man.

Kents Cavern – Oldest human dwelling in Britain



Such a rich geological heritage, sheltered aspect and subsequent micro-climate have influenced the area's remarkably diverse marine and terrestrial biodiversity. Specialist plants thrive on the thin, dry limestone soils, rare birds find homes on the cliff ledges and farmland fringes, endangered bats roost in the caves, whilst underwater seahorses shelter amongst the sea grass beds. Additionally, without doubt, it has also shaped the areas incredible human history. The protective arms of Berry Head, today a National Nature Reserve and Hope's Nose, combined with the rich red soils, created ideal conditions for both fishing and farming communities to develop. In Brixham, fishermen used the locally sourced iron ochre to help waterproof their sails and over time what began as simply a natural harbour, developed into the 2nd largest fishing port in the country. The wider bay was used as an anchorage for Nelson's fleet during the Napoleonic Wars. Torre Abbey, which has witnessed, survived and been a part of some epic moments of history, was built using considerable amounts of stone from the very headland it overlooks and was so positioned in the late twelfth century to take advantage of the fertile land and rich pickings from the sea. Beautiful scenery, clean air and clean waters led to the development of the tourism industry and ultimately what was once attractive to the cavemen is still attractive to local residents and tourists today.

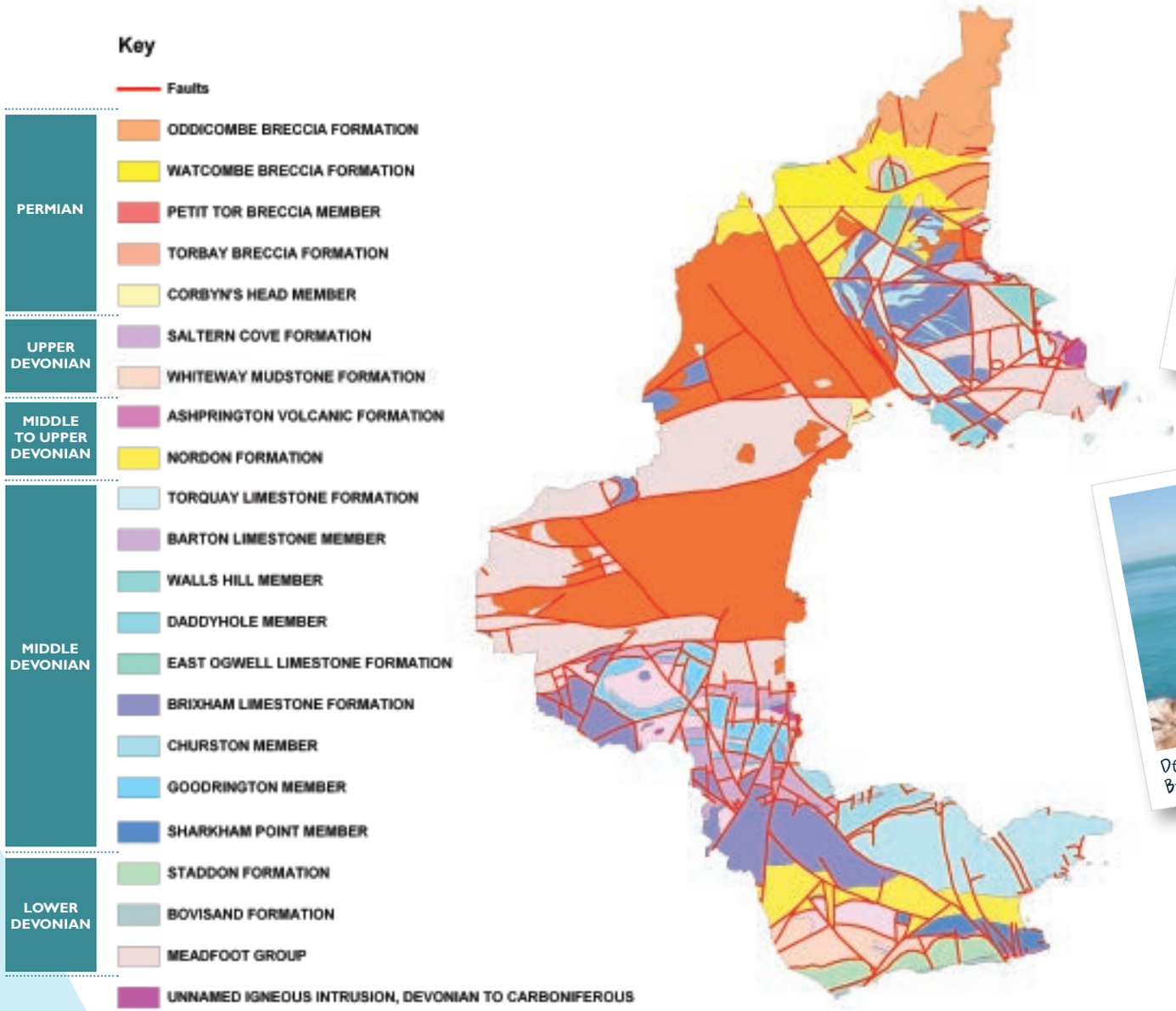
Heritage Fishing Fleet

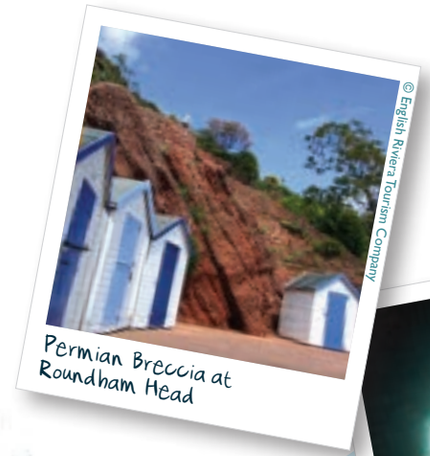
Rare small blue butterflies on kidney vetch

Cirl bunting, a rare farmland bird

The resonance of the Geopark's truly ancient roots endure in the modern make-up of the intricate coast, its architecture and buildings, its cultural and artistic heritage and its sense of region and place.

Geology Map of the English Riviera UNESCO Global Geopark





Field Trip Site Map

Babbacombe

Towards Berry Head

BABBACOMBE

TORQUAY

PAIGNTON

BRIXHAM

River Dart

RIVIERA INTERNATIONAL CONFERENCE CENTRE

HALDON PIER, TORQUAY HARBOUR
Boat trip departure point for T8 – T11

NEW FISH QUAY PASSENGER PONTOON, BRIXHAM HARBOUR
Boat trip departure point for T12 – T15

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Total area:
103.9km²
(62.4km² land,
41.5km² marine area)

Key

- Boundary of the English Riviera UNESCO Global Geopark
1. Babbacombe Cliff Railway
2. Oddicombe Beach
3. Kents Cavern
4. Hope's Nose
5. Triangle Point and Meadfoot Beach
6. Torquay Museum
7. Chapel Woods
8. Torre Abbey
9. Cockington Court and Country Park
10. Paignton Geoplay Park
11. Saltern Cove
12. Berry Head National Nature Reserve

Which sites will you visit?

Geopark Rocks
will visit sites 3, 4 and 11

Geopark Stories
will visit sites 3, 5 and 12

Overground, Underground and Cruise (Torquay Cruise)
will visit sites 1, 2, 3, 6 or 8 plus cruise

Overground, Underground and Cruise (Brixham Cruise)
will visit sites 1, 2, 3, 6 or 8 plus cruise

Culture, Creativity and Community
will visit sites 8, 9, 10 and 7

1

Babbacombe Cliff Railway

The historic Babbacombe Cliff Railway, opened in 1926, connects the tranquil setting of Babbacombe Downs, from where it is possible to view a spectacular view of Lyme Bay and across to the Jurassic Coast World Heritage Site, with Oddicombe Beach. Built down a fault line between Devonian grey limestone and a block of younger Permian red breccia it is one of the few working funicular railways left in the UK. Now run by the Babbacombe Cliff Railway Community Interest Company the railway has been transporting visitors up and down the 73 metre cliff face to Oddicombe Beach since 1926.

Opening of Babbacombe Cliff Railway, 1926

Babbacombe Cliff Railway

2

Oddicombe Beach

Popular with both locals and visitors this area of the English Riviera was once described by Queen Victoria in her journal as follows…

"We came to Babbacombe, a small bay, where we remained an hour. It is a beautiful spot which before we had only passed at a distance. Red cliffs and rocks with wooded hills like Italy and reminding one of a ballet or play where nymphs appear – such rocks and grottos, with the deepest sea on which there was no ripple." August, 1846.

Despite its beauty the Bay's geological story is a dramatic one. Here the limestones have been dramatically twisted and turned by geological forces. Around 300 million years ago, when plate techtonic action caused two huge continents to collide, the sedimentary rocks that had been laid down in the seas between the two continents were squeezed and piled up under intense pressure creating a vast mountain chain. This major episode in the Earth's history, known as the "Variscan Orogeny", had a big impact on the rocks of Torbay. Sediments were folded and fractured as they were crumpled and pushed northwards by the collision and here these cliffs contain a geological surprise! The pressure was so great that a large fold turned over on itself so that the sediments are now completely upside down and the dark slates at the bottom of the cliff between Oddicombe and Babbacombe beach are actually younger than the pale limestones of the Downs at the top!

More recently dramatic landslides have hit the headlines when over 100,000 tonnes of rockfall debris fell down across the whole beach at Little Oddicombe and the north end of the beach at Oddicombe effectively burying the former coastal landscape. It is estimated that the cliff top has regressed by about 30-40m over a length of approximately 140m, leaving a new cliff face about 5-15m in height.

Petit Tor, 1793, by Rev JB Swete

Oddicombe Beach

Oddicombe rock fall

3

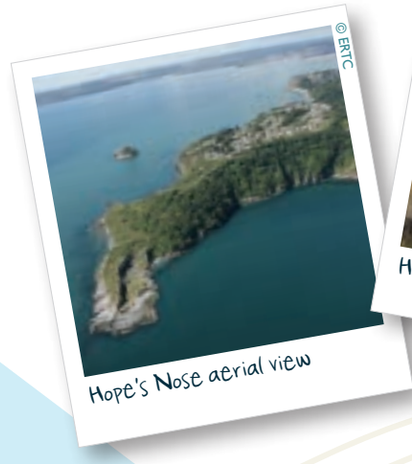
Kents Cavern

Nationally protected, this award winning prehistoric cave is the underground visitor centre for the English Riviera Global Geopark. With an extensive labyrinth of spectacular and easily accessible caverns and rich in fossil remains, the cavern has fascinated many of Britain's pioneering Earth scientists including Rev Buckland, Charles Darwin, Alfred Wallace and William Pengelly. A human jawbone discovered here is the oldest human fossil ever found in northwestern Europe. Kents Cavern's connection to humankind goes back much further to Neanderthals and *Homo heidelbergensis* over 500,000 years ago. This makes Kents Cavern by far the most important prehistoric cave in Britain. Open to the public since 1880, the cave has inspired many visitors, notably Beatrix Potter and Agatha Christie, and continues to draw in audiences for guided tours and innovative artistic and cultural events.

4

Hope's Nose

Hope's Nose provides a spectacular vantage point, but regardless of the view, the headland itself is a fascinating site for both its geology and biodiversity. The wavecut platform reveals coral and stromataporoid fossils of the ancient Devonian tropical seas. Hidden between the layers of limestone are occasional bands of volcanic ash and later deformation has created gentle undulations that give way to dramatic folds and faults all topped by the 200,000 year old raised beach. However, perhaps most remarkable, are the sites suite of rare minerals some new to science.



5

Triangle Point and Meadfoot Beach

The steep sloping surface of Triangle Point was once part of a tropical reef – but 395 million years ago during the mid-Devonian time period, it was horizontal (later tectonic movements tilted it). The surface covered in Devonian reef fossils still sit in exactly the same position as they were in life so long ago.

The shore and cliffs to the middle and east of Meadfoot Beach expose sandstones and slates which were once sands and muds in a shallow tropical sea some 405 million years ago, during the early part of the Devonian time period. These are some of the oldest rocks in Torbay, and are known as the 'Meadfoot Group', named after this bay!

6

Torquay Museum

Originally set up by Pengelly to house the artefacts from Kents Cavern the museum today displays a wide variety of exhibitions that share the areas past. It is here that most important find from Kents Cavern, a 41,000 year old human jawbone is on display as part of the Ancestors exhibition. Additionally it is possible to experience what life was like in a traditional Devon farmhouse and to enjoy Britain's only Agatha Christie Gallery which is dedicated to the life story of the Queen of Crime. Re-developed and improved in 2013, the new gallery now enables visitors to step inside Poirot's study and lounge, including furniture, books, pictures and even the fireplace from his beautiful Art Deco London apartment. Delegates who visit the museum will also have the opportunity to meet Prof Gordon Walkden who will present on the importance and context of local Devonshire Marble.

7

Chapel Woods

Chapel Woods is a small but fascinating site which contains the 13th Century St Michaels Chapel, a recently restored Scheduled Ancient Monument, perched on the top of a designated Regionally Important Geological Site. For many years both the Chapel and important geology had been hidden from view but following phased works that included tree clearance, clearance of important rock faces, improvements to the path network and restoration of the Chapel that is no longer the case.

Chapel Hill line drawing

St Michaels Chapel before restoration

8

Torre Abbey

A magnificent Grade 1 listed building, Torre Abbey is set within beautifully landscaped grounds and gardens with stunning views over Torquay. There were only ever 30 such abbeys throughout England. Along with the Spanish Barn built in the 13th Century, the abbey is one of the most important historic buildings in the South West of England. Founded in 1196 it is a very rare example of a premonstratensian abbey. The abbey is a historic building with monastic ruins, a museum and art gallery and has just been through a major refurbishment. The Spanish Barn, which is a great medieval tithe barn, was so named as it was used to imprison the 397 Spanish crew of the captured ship Nuestra Senhora Del Rosario which was captured by Sir Frances Drake during the Spanish Armada campaign. Torre Abbey is owned and managed by Torbay Council and has been open to the public since 1930.

Torre Abbey

Inside Torre Abbey

Torre Abbey restored

9

Cockington Court and Country Park

With Saxon origins, Cockington, situated in a hidden valley and surrounded by rolling farmland and orchards, retains it rural identity. Within the centre of the village you can still see the smithy, mill, granary and weaver's cottage. Cockington Court sits a little way back from the village within a beautiful arboretum with a traditional cricket lawn in front of the house. Over the last thousand years three major families have controlled the court and estate. In 1130–1350 the lands were owned by the Fitzmartin family who took the surname De Cockington. It was the De Cockingtons, who, in 1196, allowed stone to be quarried from Corbyn Head to build Torre Abbey. The property was sold to the Cary Family in 1375, who remained there until 1654. In 1521, William Cary of the Cockington Carys married Mary Boleyn, the sister of Henry VIII's second wife Anne Boleyn and thus became the uncle of the future Queen Elizabeth I when Anne Boleyn gave birth in 1533. The last family who lived here from just after the Civil War until the 1930s, was the Mallocks. Today the Court is operated by Torbay Development Agency (TDA) and is home to a vibrant centre for arts and crafts. The wonderful landscape and Country Park is managed by Torbay Coast & Countryside Trust.

Ourglass at Cockington

Cockington Court

Rex Latham Blacksmith at Cockington

10

Paignton Geoplay Park

The Paignton Geoplay Park, an open access children's play park, has been a major success story and it is in the park that we have had the opportunity to explain the local geology in simple terms. The park is divided into four areas the Devonian, Carboniferous, Permian and Quaternary where the play equipment and landscaping tells the tale of each period. Colourful, attractive and engaging interpretation panels support this whilst the story telling chair shaped as a spiral pictorially depicts the whole of geological time. The park provides an ideal setting within which the Geopark's creative Geo-collective and trained Play Rangers can engage with children and adults. Delegates will hear about the community development of the park as well as explore and play!

Story telling chair, Geoplay Park

Climbing net, Geoplay Park

Geoplay Park

11

Saltern Cove

From Goodrington, South Sands around to Saltern Cove this beautiful stretch of sheltered coves and exposed cliffs not only boasts fantastic geology but also supports diverse communities of intertidal life. As a result, in addition to its geological SSSI designation, it is also the only underwater SSSI in the country and a marine local nature reserve. It is here that one of the most important Upper Devonian stratigraphic localities in Britain is exposed whilst close by the unconformable contact between the Lower Devonian and the overlying Permian beds is clear. Additionally, an abundance of fossil burrows found nearby are evidence of life within the Permian desert. Theories regarding the resident of the burrows have ranged from giant sandworms to small reptiles, with the current favourite being giant millipedes.

Saltern Cove

Unconformity at Waterside Cove

12

Berry Head National Nature Reserve

Berry Head, with its 60 metre (200 feet) high cliffs has for centuries offered shelter and protection to wildlife, people and nation. Integrating the fragile, rare plant and insect life of its limestone grassland, the thousand-strong guillemot colony (the most southerly in the UK) and its many sea caves the site holds a hugely impressive list of official designations all of which hint at its national and international significance for nature conservation. Particular rarities include the small blue butterfly, cirl bunting, white rock rose, several orchid species and the Devonshire cup coral. The heart of the headland is 400 million year old limestone that once formed part of a reef environment in a shallow tropical sea south of the equator. Berry Head is an exceptional, strongly interrelated site, and people as well as geology have shaped Berry Head, most dramatically by quarrying its limestone over the last 300 years. Used to build the Napoleonic forts, quarrying continued even up to the 1950s. Today the quarry's quiet seclusion is ideal for a range of wildlife from seabirds to the protected nursery roost of the greater horseshoe bats.

Guillemot colony

Berry Head aerial view

Greater horseshoe bats

Geopark Boat Cruises (Please note the cruises are weather dependant)

With a rich mosaic of beaches, sheltered coves, blood-red bluffs and steel grey sea stacks, interwoven with seafront proms and bustling harbours one of the best ways to view the spectacular geology and landscape of the Geopark is from the sea. Such a rich geological heritage of coastal cliffs and rocky islands has influenced the area's remarkably diverse marine and terrestrial biodiversity and the boat cruises will provide an opportunity to enjoy spectacular views and wildlife. If lucky on the day there may even be glimpses of seals and dolphins.

Those on the cruise departing from Torquay Harbour will be treated to the sight of incredible deformation structures of the Marine Devonian limestone from the Harbour all the way to Hopes Nose with its renowned raised beaches. Also watch out for Hesketh Crescent where Darwin resided in the summer of 1861 and the incredible fold on the island of Orestone. Whilst in residence at Hesketh Crescent, Darwin wrote in a letter to Charles Lyell (dated 20 July, 1861) "*Lady Lyell & you will be glad to hear that Etty improves a little. This is a quite charming place & I have actually walked I believe good two miles out & back, which is a grand feat. – I saw Mr Pengelly the other day & was pleased at his enthusiasm.*" Pengelly was responsible for the main excavations of Kents Cavern.

For those on the cruise from Brixham Harbour there are sights and sounds of the UK's 2nd largest fishing port to enjoy before heading around to Berry Head. On route in addition to watching out for some of the bays wonderful wildlife look out for the fissures in the grey limestone in filled with the bright red, younger Permian sandstone, these features called "Neptunian Dykes". Take in the incredible view of the Napoleonic Fort and the position of the most southerly guillemot colony in the UK used for monitoring climate change.

TORBAY COUNCIL

TDA

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