



Easington AN  
**ADVENTURE  
IN TIME**

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the  
unique landscape  
of the East Durham coast

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landscape of the  
east Durham  
coast

# AN ADVENTURE IN TIME

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Standing today on the cliffs, looking across eastern Durham and out to sea it is easy to imagine the landscape as something permanent which, despite social and economic changes, has always been there. This apparent tranquillity belies the dramatic events which have shaped the scene and which can be deduced from reading the evidence contained in the landscape and the rocks beneath it.

As the tides turn today it is worth reflecting that countless tides have turned over millions of years on what is now the Durham coast.

Original research and text by

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*Introduction*

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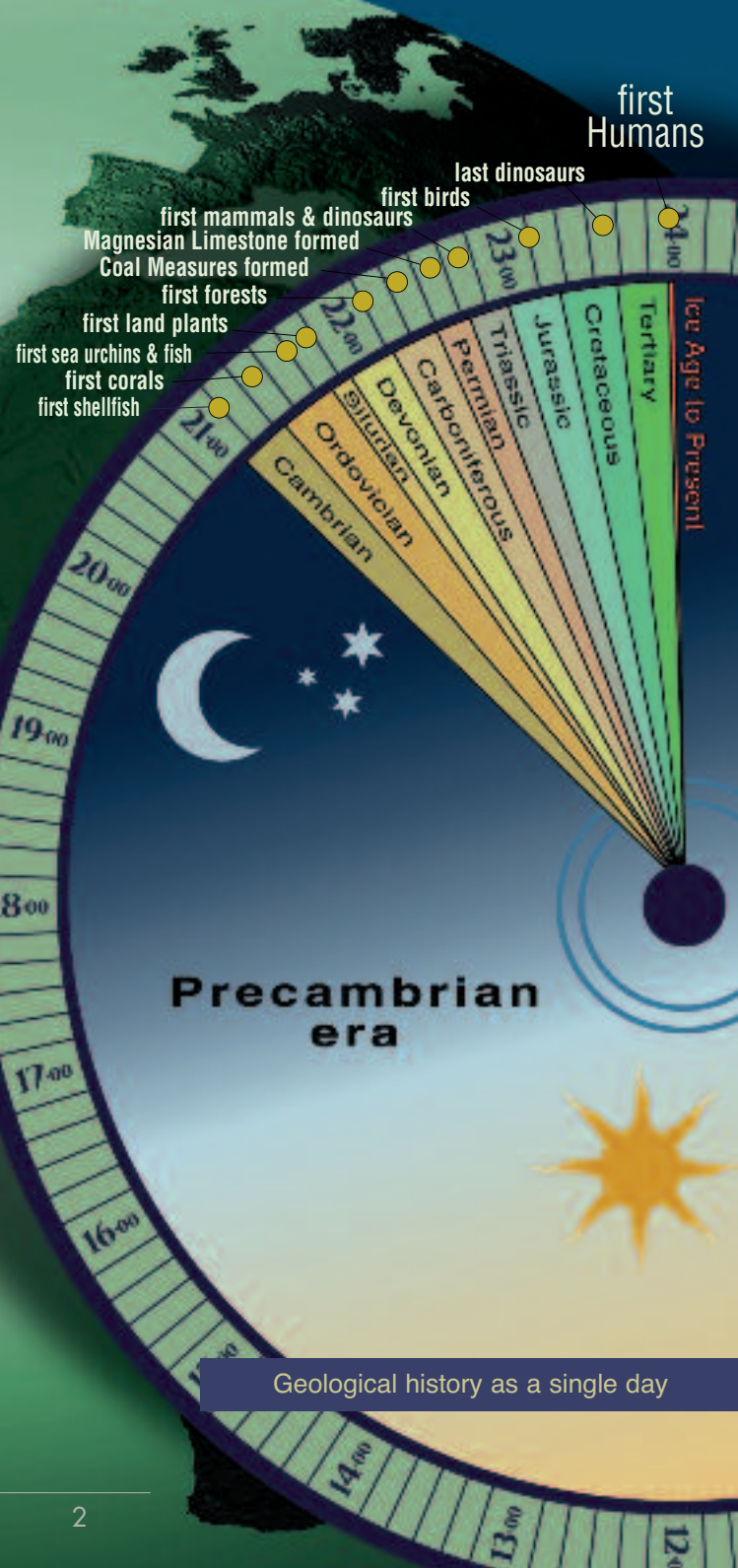
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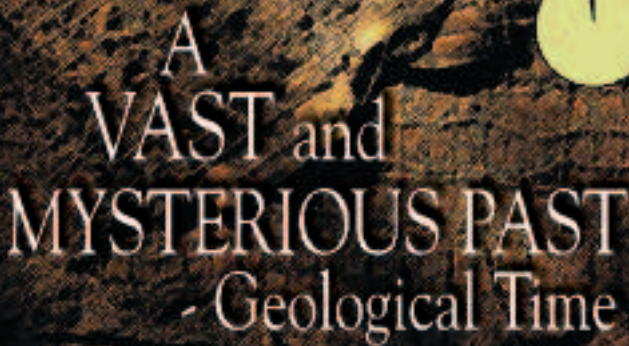
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# A VAST and MYSTERIOUS PAST - Geological Time

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To most people, one thousand, one hundred, even ten years seems a long time. The many millions of years in which earth history must be measured – the earth is believed to be about 4500 million years old – is almost impossible to imagine. A good way of trying to grasp the enormity of geological time is to think of the history of the earth as a single day. On this scale the coal seams of County Durham formed between 10.15 and 10.30pm, the Magnesian Limestone, which we see today in the cliffs of the Durham coast, formed at between 10.30 and 10.40pm. Human life dates back to only about 2 seconds to midnight and the last ice age started at about 1 second to midnight.

The story of the Durham coast therefore occupies only a small fraction of the earth's long history, though a great deal has happened during that time.

Geologists decipher earth history by studying the rocks formed at different periods in very much the same way as archaeologists interpret human history from coins, pottery etc. left by our ancestors.

The rocks we see today give clues to the processes which formed them. It is important to understand that the processes which operate in the world today are essentially those that have always operated. For example, rivers have always washed mud and sand into lakes and seas; volcanoes have always erupted ash and lava, etc. To the geologist “the present is the key to the past”.

The rocks we see in even a small area such as the Durham coast tell a fascinating story of moving continents, tropical seas, arid deserts and freezing ice-sheets. This is the story . . .



Reconstruction of Coal Measures Swamp

# STEAMING SWAMPS and FORESTS

The oldest rocks of the Durham coast tell us of a very different world about 310 million years ago, during the period of the earth's history which geologists call the Carboniferous period.

At this time the area destined to become Great Britain lay almost astride the equator. Enormous

rivers flowing from the upland areas, which are now the Scottish borders, and parts of the North Sea deposited huge quantities of mud and silt, forming deltas. These formed a vast, low lying tropical swamp which is the area now known as County Durham.

Great forests of primitive trees, giant ferns and other vegetation covered these swamps. The trees were not like those we know today. They included relatives of the small club-mosses, found today on some of the high mountains, as well as early ancestors of the modern conifers. There were no true

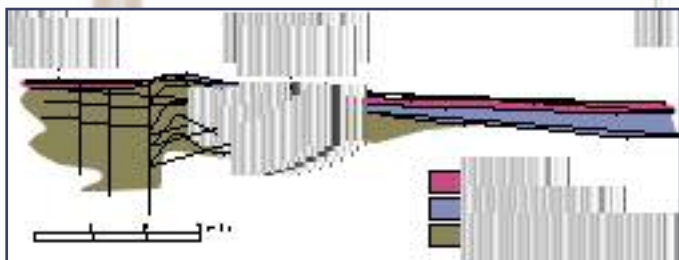




flowering plants at this time. Huge amphibians, rather like newts, lived in the swamps and giant insects flew from tree to tree. Thick layers of dead vegetation, which built up on the forest floor, were buried by mud and sand spilling from the rivers. As these became compacted over time they became the coal seams of the Durham Coalfield. Many of the trees and plants and, much more rarely, the animals, were preserved as fossils. The rocks, including the coal seams, that formed at this time are known as the Coal Measures.

At the end of the Carboniferous period great earth movements, caused by the movement northwards of this part of the earth's crust, squeezed and folded the coal seams and other rocks and pushed them up to form hills. Weathering of this new landscape prepared the area for the next period of earth history.

Coal Measures rocks are seen today in the centre of the county and are buried deeply beneath the Magnesian Limestone at the coast and beneath the North Sea.



Sketch section through southern part of Durham coalfield to illustrate pre-Permian folding and erosion.

background: Reconstruction of Coal Measures Trees

# ARID DESERTS and SALTY SEAS



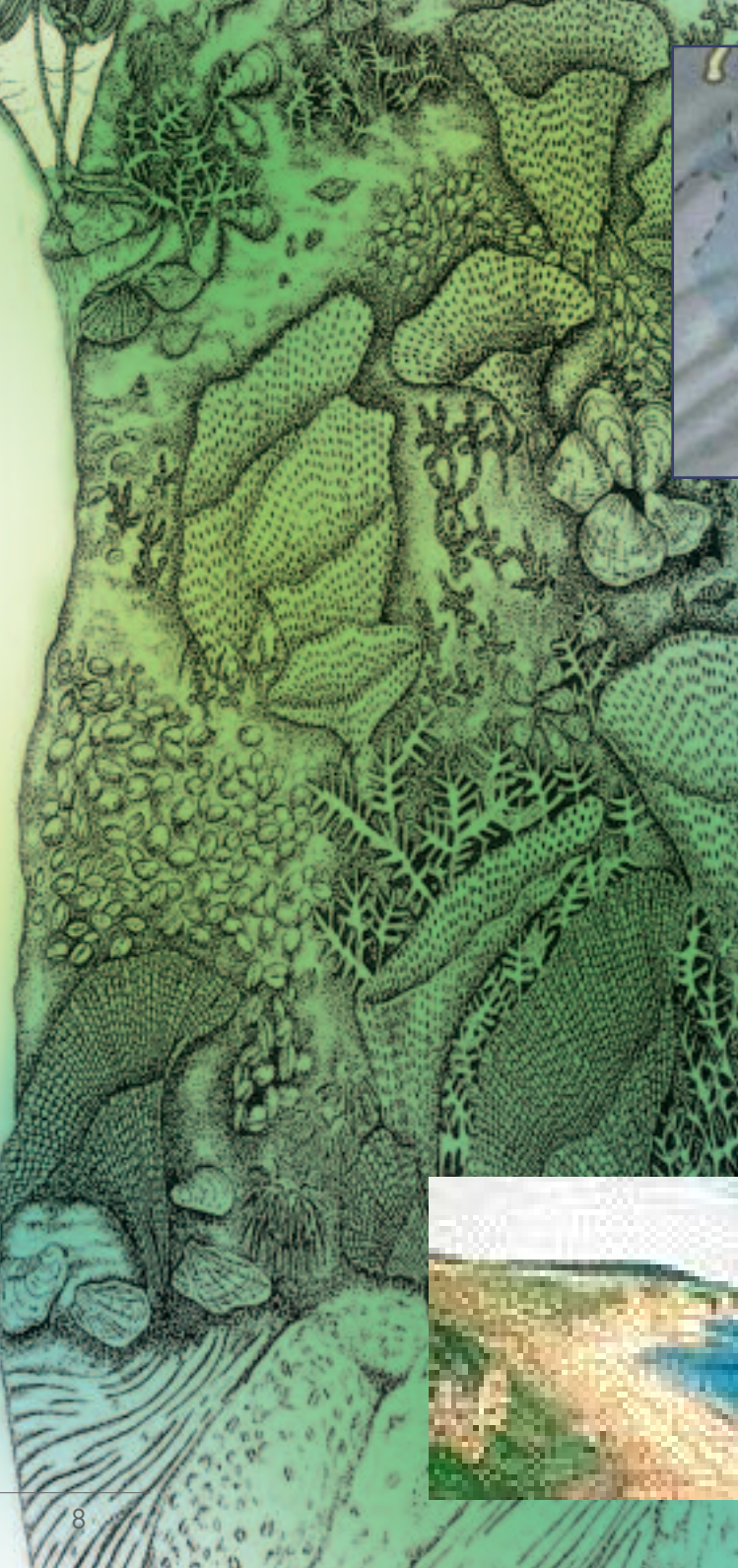
As weathering wore away the Coal Measures rocks and as the area moved slowly further north from the equator, the climate changed to an arid desert. This was the period of earth history known as the Permian period, about 295-250 million years ago.

At the beginning of this time much of what is now County Durham and the North Sea was a hot barren desert covered by sand dunes. We see these today as the “Yellow Sands” which are worked for building sand around Sherburn and elsewhere in east Durham.

These sands are present at depth beneath the Durham coast and because they are typically soft and contain huge quantities of water, presented major problems in the sinking of the coastal collieries. Beneath parts of the North Sea these sands are reservoirs of oil and gas.



Quarrington Hill - a section through 290 million year old desert sand dunes





Eventually the desert was flooded as the Zechstein Sea, which occupied an area similar to the modern North Sea, spread rapidly across the area as far as the present day eastern edge of the Pennines. Thick deposits of limey mud, which accumulated on the floor of this warm sea, became compressed and hardened forming the pale yellow Magnesian Limestone which is such a familiar part of the east Durham landscape and coastal cliffs.

A thin bed of grey bituminous limestone at the base of the Magnesian Limestone and known as the Marl Slate, is famous for the many beautifully preserved fossil fish it contains. Fine specimens have been collected from quarries in the Sherburn and Quarrington areas.

A long barrier reef formed close to the coast of the Zechstein Sea. Unlike modern reefs this was not built of corals but mainly of the skeletons of bryozoans (“moss animals”) and other marine animals. The reef today forms a number of conspicuous hills, including Beacon Hill, and reaches the present day coast at Blackhall Rocks.



Beacon Hill today

Fossils of bryozoans and a variety of shells can be found in these reef limestones.

The name Magnesian Limestone reflects its composition as it commonly contains large quantities of the magnesium-rich mineral dolomite.

Periodic evaporation of water from the Zechstein Sea in the hot Permian climate caused minerals normally dissolved in the water to crystallise, forming thick beds of anhydrite and gypsum and more rarely rock salt and potash. These minerals are collectively known as evaporites. Anhydrite used to be mined at Hartlepool and Billingham for making cement and chemicals. Salt is extracted as brine from boreholes near Hartlepool. Potash is mined today at Boulby in North Yorkshire.

Near to the surface these very soluble minerals (evaporites) dissolve causing the overlying limestone to collapse.

The rubble-like appearance of much of the limestone in the Durham cliffs is a result of this process which took place millions of years ago.





# AN EERIE SILENCE

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The record of earth history which can be deciphered from the rocks of the Durham coast, falls silent after the formation of the Magnesian Limestone.

There are no rocks in this part of County Durham which record the events of the next 250 million years.

What is certain, however, is that during this huge period of time the limestones were raised up to form hills and the area continued its relentless journey northwards to its present position.





# DURHAM SHIVERS ...

During the last 2.5 million years, the polar ice cap spread southwards across much of Britain and Northern Europe on several occasions. At times County Durham and the North Sea were buried beneath ice sheets up to 1 kilometre thick. Between these long cold spells the climate became at least as mild as today, only to be followed by another severe cold spell as the ice sheets returned. The most recent thick covering by ice dates from about 18 000 years ago.

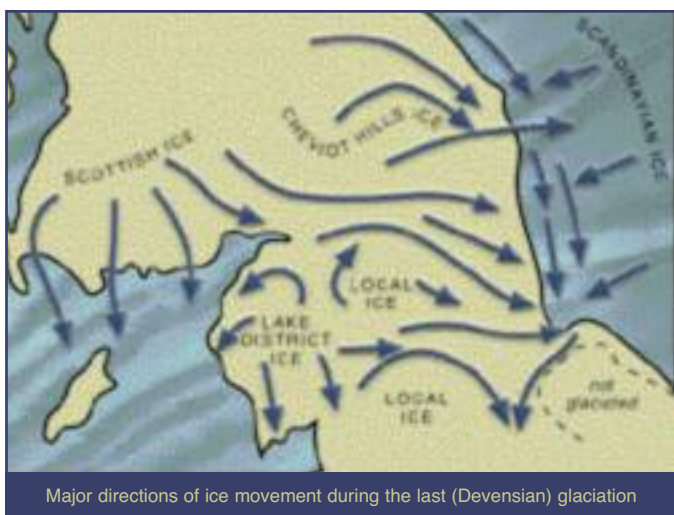
The history of this glacial period, as revealed by the deposits of clay, sand and gravel, left behind by the ice, is very complex. However, we know that ice moved across the area from the north and west bringing rocks from the Cheviots, Pennines and Lake District. Other ice sheets spread across the North Sea carrying lumps of Scandinavian rocks. These boulders, known as “glacial erratics”, together with vast amounts of clay and sand, embedded in the ice, were dumped as the ice melted, to form the thick spreads of boulder clay which today cover much of East Durham. The boulder clay is conspicuous as a capping of brown stony or sandy clay lying above the Magnesian Limestone of the cliffs. Pockets of sand and gravel were deposited by



glacial meltwater. A great variety of “glacial erratics”, weathered out from the boulder clay, can be found on most beaches. Most common are lumps of grey limestone and buff sandstone from the Pennines, dark grey dolerite from the Whin Sill, a variety of volcanic rocks from the Cheviots and Lake District and more rarely, granites and gneisses from Scandinavia.

When the great weight of ice was at its thickest, it pushed the land surface downwards. Then, as the ice melted and this weight was removed, the land rose. Over time, sea level, and thus the position of the Durham coast, has changed many times. Some very distinctive deposits produced by these sea level changes can be seen in a few places. At Easington, near Beacon Hill, there is a “fossilised”, or raised beach which is now about 30 metres above present day sea level.

Elsewhere, e.g. near Hartlepool, tree stumps which are about 8-9000 years old, today lie about 15 metres below sea level.



# ...AND THEN WARMS UP



As the last ice sheet melted, around 10 000 years ago, huge volumes of water were released as rivers and streams began to flow again. Combined with the gradual rise of the land surface as the weight of the ice was removed, some of the new streams cut deep gorges.



Hawthorn Dene

The denes of the Durham coast were formed in this way as the streams cut through the boulder clay and into the underlying Magnesian Limestone. It was at this time that the gorge of the River Wear at Durham was cut.

With the final melting of the last ice, the North Sea resumed its attack on the Durham coastline. As the waves pound the cliffs the limestone and overlying boulder clay collapse from time to time, maintaining the steep cliff profile.

Masses of limestone, more resistant to the battering, create isolated pillars or sea stacks at several places. Pockets of much softer limestone

are worn into caves and arches.

As the land surface emerged from beneath the ice and as the climate continued to warm up, vegetation gradually returned. At first County Durham was covered by tundra (where the sub-soil is frozen) vegetation but, with further warming, the vegetation we see today became established.



Caves at Blackhall



Stack at Blackhall

The comparatively large areas of bare limestone soil, combined with the unusual magnesium-rich nature of the Magnesian Limestone, gives a wealth of beautiful, uncommon and rare plants for which the Durham coast is famous.





# THE RETURN of the PLANT LIFE

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The rich diversity of habitats and the plants and animals which live within them are inextricably linked to the geology of the area.

This unique combination has led to the designation of most of the coast as a National Nature Reserve and various Sites of Special Scientific Interest for either their geological or botanical importance.

The next sections describe the flora and fauna, arising from the long geological history, which can now be enjoyed along the East Durham coast.



# THE GRASSLANDS

92% of the coastal Magnesian Limestone grasslands in Britain occur here in County Durham and in summer these grasslands are a mosaic of changing colour.

On the boulder clay which covers the sea banks and cliffs, extensive grasslands lie between Nose's Point in the north and Hart Warren in the south. On the drier slopes where the soils have developed directly on Magnesian Limestone, or where the boulder clay forms only a thin layer, the richest plant communities can be found.

Grassland species occurring in abundance are Red Fescue, Glaucus Sedge, False and Downy Oat-grasses and Quaking-grass. The brilliant Bloody Cranesbill occurs frequently together with Primrose and Carline Thistle.

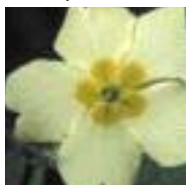
County rarities also occur, such as Fragrant Orchid, Pyramidal Orchid, Round-leaved Wintergreen



Carline Thistle



Pyramidal Orchid



Primrose

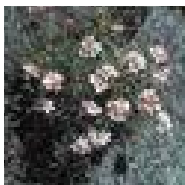
and Yellow-wort which reaches its northern limits here on the Durham coast.

On the exposed headlands, affected by salt spray from the sea, and known as maritime grasslands, are species such as Sea Plantain, Thrift and Common Scurvy-grass. Sea Spleenwort grows on the more rigid limestone cliffs.

At Blackhall Rocks, where the Magnesian Limestone forms cliffs, wet limestone flushes occur and uncommon species such as Butterwort, the dainty Bird's-eye Primrose and Grass-of-Parnassus (not a grass at all but a pretty perennial herb with heart shaped leaves and white flowers) can be found. The Common Rockrose is an important plant growing in this area as it is food for the Durham Argus Butterfly. This special butterfly is a nationally notable species. Its habitat has been enhanced by the 'Turning The Tide' project.



Common Rockrose



Thrift



Common Scurvy-grass

Common Rockrose is also the food plant for the two day-flying moths, the small bright green, Cistus Forester and the rare Least Minor Moth which also feeds on the Glaucus Sedge.

In the sheltered hollows of the cliffs or in the grasslands, on a still day, a bright flicker of colour may give away the presence of one of the many common butterflies.

The Common Blue, Orange Tip, Wall Brown and Dingy Skipper are all common butterflies to be found in the locality. The Dark Green Fritillary Butterfly (whose actual colouring on the uppersides of the wings is orange-brown with strong black markings) has also been seen.

Burnet Moths, with their striking pink spots, can also be found flying on a sunny day during the summer months. Bird's-foot Trefoil appears in abundance in these coastal grasslands and is an important food plant for some of these insects.

A careful search may reveal the rarely seen Slow-worm. This reptile is actually a type of lizard (it has eyelids and ear holes, which a snake does not). They particularly like warm, damp spots amongst the vegetation.

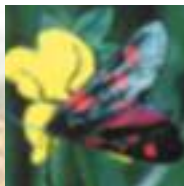
The Common Toad, Common Frog and Smooth Newt are amphibians commonly discovered in the seasonal freshwater pools.



Common Blue



Dingy Skipper



Burnet Moth



# THE COASTAL

The denes reveal remnants of ancient semi-natural woodland, which cling to the steeply sloping sides. It is the inaccessibility and topography of these woodlands that has allowed them to escape the rigours of clearance for agriculture. Ash and Wych Elm trees grow on these slopes where the shallow soils tend to be light, dry and lime-rich. Climbing towards the upper slopes, where the soils become less alkaline, Oak becomes more dominant. The rich array of flowers carpeting the floor of these old woodlands is characteristic of base rich soils.



Oak Woodland



Wild Garlic



Herb Paris

These may include Wild Garlic, Wood Anemones and Sweet Woodruff.

Less common flowers such as Herb Paris, False Oxlip (whose parents are a Cowslip and a Primrose) and Great Horsetail are also present.

Castle Eden Dene is a National Nature Reserve. It has the largest and best preserved gorge woodland on the Magnesian Limestone in Britain.

# DENES



Yew



Snowdrops



Roe Deer

In the moist bottom of the dene, where the light reaching the woodland floor is limited, fewer plants are found but there is a rich bryotype flora (mosses and liverworts). Amongst this damp green carpet, Golden Saxifrage and the uncommon Hart's-tongue Fern can be found. The Yew, a native conifer, also grows here on the thin limestone soils. It is unusual to find this tree growing in such abundance in the North-East.

Hawthorn Dene is designated a Site of Special Scientific Interest. It is an Ash woodland but interference from man can be seen with the planting of exotic trees such as Walnut, Lawson's Cyprus and Norway Maple. A beautiful display of Snowdrops on the more gently sloping ground in Hawthorn Dene is a popular feature of this woodland in spring.

A series of smaller woodland denes, such as Ryhope, Seaham and Crimdon, cut into the coast and form a network of semi-natural woodland habitats. While none of these approaches the richness of the two larger denes, they provide a valuable habitat for a variety of woodland animals.

There are suitable conditions for a wide range of woodland birds, particularly the large numbers of breeding Tree Creepers and tits. In spring, migratory birds arrive in great numbers and the woodland becomes alive with birdsong. Some 160 species of bird have been recorded.

The steep sides of the denes offer opportunities for animals such as the badger and fox to build earths and burrows for shelter. Other mammals to observe include Roe Deer, stoat, hare, rabbit, hedgehog, Pipstrelle Bat and small rodents such as mice and voles.

As the plant communities are rather special, the insects they attract to their food supply are special too, particularly the moths.

Captain Blomer first discovered Blomer's Rivulet Moth in Britain in Castle Eden Dene, in July 1831. It is still the only locality in

Northumberland and Durham where the moth is recorded. Its larva feeds on Wych Elm in late summer and the adults can be found in June and July on leaves and tree trunks.



Honeysuckle



Lilac Beauty



Rabbits

The Lilac Beauty Moth has its stronghold in the denes and may be easily spotted flying at dusk. Its larva feeds on Honeysuckle and Ash. Other moths to look out for are Clouded Magpie and Green Arches.

# COASTAL BIRDS



Little Tern



Purple Sandpiper



Kittiwake

There are several good viewing points to interest bird watchers, particularly during the autumn migration. These include Dawdon Blast beach, Castle Eden Denemouth, Blackhall Rocks and Crimdon Dene. Two of the most significant species of bird on the Durham Coast are the Little Tern and the Purple Sandpiper.

The Little Tern breeds in Britain in internationally important numbers.

The colony at Crimdon is nationally important. Little Terns breed from late May to August, nesting in the sand where they are often flooded in high tide. They migrate to West Africa in winter.

The Purple Sandpiper is a rare wading bird which gathers along the coast in Winter, feeding on the rocky shore and often roosting on the harbour wall at Seaham. In Summer, they migrate back to the arctic wastes to breed and raise their young.

Some other sea and shore birds which can be seen on the East Durham Coast are: Eider Ducks, Fulmars, Kittiwakes and Oystercatchers.



# HUMAN INFLUENCES

Although humans have only been on earth for a very short space of time, relative to geological time, their actions have affected and continue to affect the landscape all around, including here, on the east Durham coast.

Little is known about early human history in County Durham. Former settlement sites, tumuli (pre-historic burial sites) and an abundance of scattered flint tools record widespread settlement dating from shortly after the melting of the ice sheets. For centuries the Magnesian Limestone offered rich farmland and there is evidence of Medieval farming with distinct ridge and furrow patterns on many sites within the area. Increasing demands for food, particularly during the Second World War meant that older pastures were ploughed up and this destroyed much of the grasslands on the cliff tops. The quarrying of limestone for making quick-lime, which was used in agriculture, became important and there are the remains of limekilns in the area. More recently, limestone as a raw material for the chemical industry has become increasingly important.

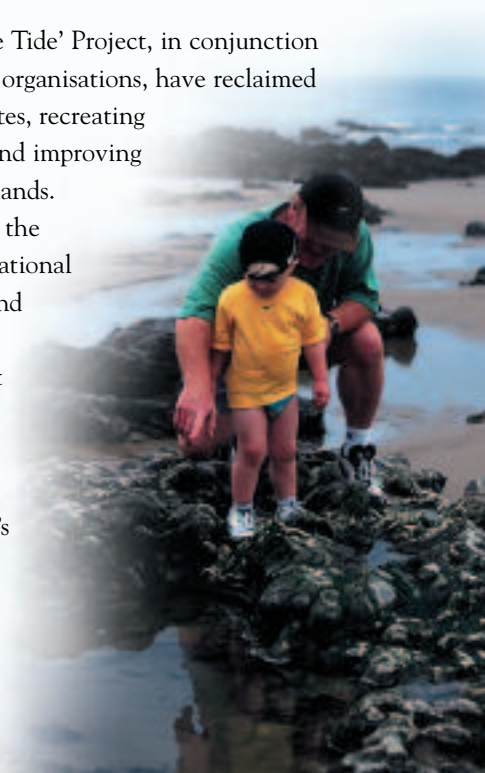
Without doubt the industry which has had the most dramatic effect on the area has been coal mining. Although it has been an essential

feature of central Durham for centuries, it was not until the 19th century, with the discovery that the Coal Measure rocks continued eastwards beneath the Magnesian Limestone, that mining came to east Durham. Shafts were sunk to exploit the rich untouched seams deep beneath the limestones, with some workings extending several miles under the sea. Mining has now ended but its legacy has remained in the numerous pit villages and in the concentrations of colliery spoil dumped onto the coast.

Much of the spoil has now been removed and the action of the sea is continuing the process of cleaning up the beaches. Some spoil, which remains at Hawthorn Hive is interesting for the occurrence of a number of unusual minerals, such as sideronatrite and natrojarosite, which are forming where the minerals in the spoil are reacting with sea water.

The 'Turning The Tide' Project, in conjunction with a number of organisations, have reclaimed the old colliery sites, recreating natural habitats and improving the existing grasslands.

At the same time the designations of National Nature Reserve and Sites of Special Scientific Interest ensure that the area is protected for wildlife as well as for people's enjoyment.



## Acknowledgements:

Front Cover: Wall Brown Butterfly, *John Hope (English Nature)*; Coastal Grasslands, *Mike Lowe*; Coastline at Blackhall Rocks.

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Page 10: Fossil fish, *reproduced from W. King's 1850 Palaeontographical Society Monograph of Permian Fossils in England, by permission*.

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Pages 19 - 25:

Carline Thistle, Thrift, Common Scurvy-grass, Wild Garlic, *Durham Wildlife Trust*;

Pyramidal Orchid, *Mike Lowe*;

Primrose, Common Blue Butterfly, Dingy Skipper Butterfly, Herb Paris, *John Hope (English Nature)*;

Common Rockrose, Burnet Moth, Honeysuckle, *Gen Batey (Malton Associates)*;

Oak Woodland, detail of Yew, *Jane Young, (Young Nature)*;

Roe Deer, Rabbits, Kittiwake, *Darin Smith*;

Lilac Beauty Moth, *Terry Coult*;

Little Tern, *RSPB Images, photographer Chris Gomersall*;

Purple Sandpiper, *RSPB Images, photographer Mike Lane*.

Page 26: Easington Colliery before its demolition in 1994, *District of Easington Past & Present Archive*.

Page 28: The beach at Seaham, *Philip Nixon*.



# Turning the Tide - A Millennium Project

## Partners:

The Millennium Commission  
Durham County Council  
District of Easington  
The National Trust  
One NorthEast  
The European Union  
The Countryside Agency  
Northumbrian Water  
English Nature  
Durham Wildlife Trust  
Groundwork East Durham  
The Environment Agency  
Northern Arts  
Seaham Harbour Dock Company

Following the success of the Turning The Tide project, The Countryside Agency designated the newly regenerated coastline as a **Heritage Coast** in April 2001.

## Further Information

For further information about this area and things to see and do please contact:

### Durham County Council

Tel. 0191 383 3354 (*answering machine outside office hours*)

### District of Easington

Tel. 0191 527 0501 ext. 2238/2281

Other leaflets in this series are:



As well as a selection of **village walks** leaflets.



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