

Welcome to **The Chevin Forest Park Geology Trail**. With its distinctive topography and geology, The Chevin is a wonderful and safe place from which to explore and understand the underlying geology and subsequent erosion (by ice and water) of what is today known as **Lower Wharfedale**.

In the centre of this leaflet is a geology trail which includes a number of **marker stones** at which you can stop and read the relevant information about the geological features. The trail is designed to explain how the rocks and fossils of The Chevin were formed and to show how the landscape of the area is related to the rock types and geological processes that have taken place in the last 300 million years. There is more geological information to be found on the **interpretation board** at **Surprise View**.

There is also an **audio trail** available on the **Friends of Chevin Forest** website www.chevinforest.co.uk. This will take you around the trail and give you additional information on the rocks and the landscapes, with a fuller description of the views you can see on the trail.



Marker stones for each location were provided by **Blackhill Quarry** in Bramhope and carved by the local artist **Shane Green**. Each carving is related to the geological feature found at that location.

This Geology Trail has been set up by a partnership

between **Leeds City Council**, **The Friends of Chevin Forest**, the **West Yorkshire Geology Trust** and the **Leeds Geological Association**. It has been funded by the **National Lottery** through the **Heritage Lottery Fund** as part of a larger history project called "**Chevin Through Time**". There is also a **Heritage Time Trail** with leaflet and audio trail on another part of The Chevin. To find out more about "**Chevin Through Time**" go to www.chevinforest.co.uk

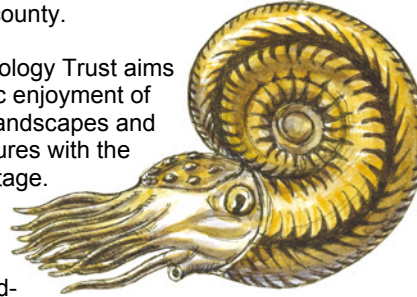
Toilets, light refreshments, leaflets and other information is available from the **White House Café** which is open most **weekdays 10am to 2pm** (check the noticeboards for seasonal changes in opening). For information about access for less mobile people and the use of **mobility scooters**, please contact the **Chevin Estate Officer** on 0113 395 7400.



West Yorkshire Geology Trust is part of a national network of groups which are actively conserving important geological features. These sites include rocky crags, active or disused quarries, railway cuttings and stream beds. Important sites are called

Local Geological Sites (LGS), of which The Chevin is one of about 70 in the county.

West Yorkshire Geology Trust aims to encourage public enjoyment of rocks, fossils and landscapes and link geological features with the local industrial heritage. We also maintain a database of Local Geological Sites and encourage land-owners and managers to participate in good site practice and management, as well as make information on Local Geological Sites available to local authorities.



Carboniferous goniatite *Reticuloceras bilingue*. Illustration, trail map and leaflet design by **Richard Bell**

www.wyorksgeologytrust.org



HOW TO FIND CHEVIN FOREST PARK

BY CAR: Follow the signs from Otley town to car parks on East Chevin Road

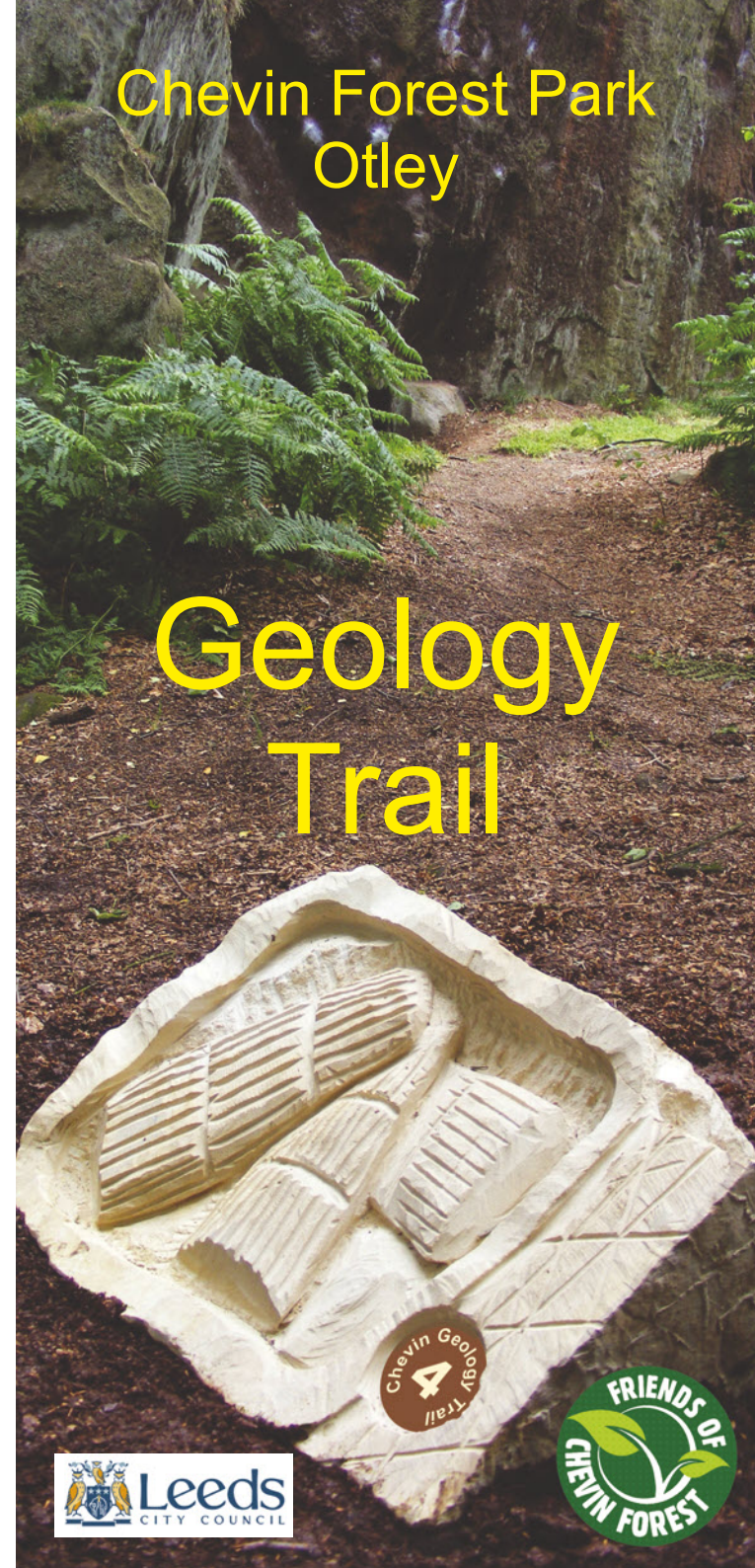
BY BUS: Travelling from Leeds City bus station, Ilkley, Skipton, Chevin Forest Park can be reached by the X84 service. Telephone 0113 245 7676 for details or go to www.wymetro.com



This leaflet is available in braille and large print, telephone 0113 395 7400.



Supported by **The National Lottery** through the Heritage Lottery Fund



Chevin Forest Park Otley

Geology Trail



CARBONIFEROUS TIMES

The rocks of The Chevin area are **Upper Carboniferous** (about 315 million years old). The sands and muds that now form the rocks were deposited by rivers on the edge of a large continent, with mountains to north and south.

Because the area was close to the equator, the climate was warm and wet so tropical rain forest flourished. Dead plant material became trapped in stagnant swamps between water channels. Rivers changed position during floods and built up more sand and mud on top. Water, oxygen and hydrogen were driven out of the plant remains, leaving only the carbon which was eventually compressed into **coal**. At least a kilometre of sand and mud was deposited above the sediments, slowly **cementing** and **compressing** them into solid rock. Water was squeezed out and minerals cemented the sand and mud grains together to make **sandstones** and **mudstones**.

The mudstone beds include **fossils** of marine creatures, such as **brachiopods**, **bivalves** and **trilobites**. This shows that sea-level must have risen from time to time about 315 million years ago and flooded the low lying land.

Sea-level changes occurred because the land at the South Pole at that time had a large ice-cap which fluctuated in size. When there was a cold period, snow remained on the ice-cap and was compacted into ice, making the ice-cap thicker. Because there was less melting, water did not return to the oceans so sea levels fell. In warmer times, the ice-cap melted so sea levels rose again.

When sea-levels rose, water flooded back between the Carboniferous mountains and covered the delta, bringing marine creatures with it. When they died they were buried in muds on the sea-bed, where some of them have been preserved as fossils.

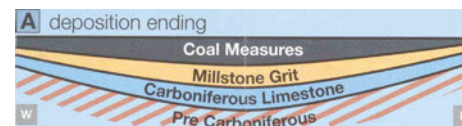
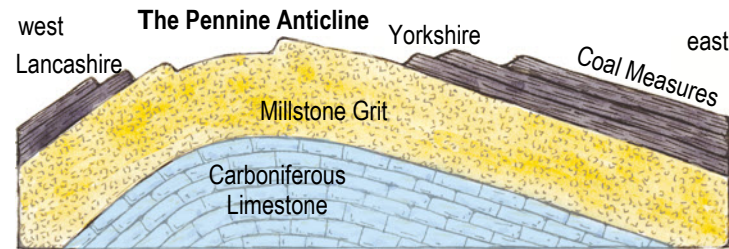
AGE	GEOLOGICAL PERIODS	LATITUDE OF BRITAIN	MAJOR EVENTS	mountain uplift
2Ma	QUATERNARY			mountain uplift
100Ma	TERTIARY	54° N	Extinction of dinosaurs	mountain uplift
	CRETACEOUS	40° N	Chalk formation	
200Ma	JURASSIC	20° N	Dinosaurs	
	TRIASSIC		Limestone formation Salt, potash formation	
300Ma	PERMIAN	10° N	Desert conditions	mountain uplift
400Ma	CARBONIFEROUS	equator	Coal Measures Millstone Grit Carboniferous Limestone	
	DEVONIAN	20° S	Semi-desert	mountain uplift
500Ma	SILURIAN		Shale, mudstone (now slate)	
600Ma	ORDOVICIAN	60° S		
600Ma	CAMBRIAN		Early invertebrates	
600Ma	PRECAMBRIAN		Early life	mountain uplift
4600Ma	FORMATION OF EARTH			

Ma - Millions of years

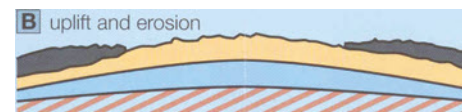
FOLDING AT THE END OF CARBONIFEROUS TIMES

At the end of the Carboniferous period, a major collision between two tectonic plates culminated in the uplift of a high mountain range across southern Europe in a series of events called the **Variscan orogeny**. This affected south-west England more than the rest of Britain. However, northern England was uplifted into the **Pennine anticline** (an upfold), which trended north-south from the Midlands to southern Scotland.

In addition, the Lower Wharfedale area was folded into an anticline which runs east-west along the Wharfe valley. Otley Chevin lies on the south side of the fold so the rocks slope southwards towards Airedale, as shown in the cross-section on the other side of the leaflet. You will see the angle of slope of the rocks in Yorkgate Quarry.

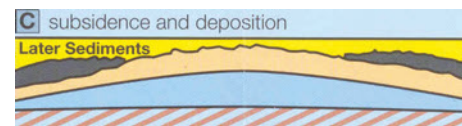


A. At the end of the Carboniferous period, sediments were being compressed into solid rock by the weight of deposits above them.



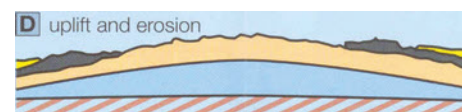
of the area and the subsequent weathering and erosion.

B. During the late Carboniferous and early Permian periods, a plate collision further south led to the uplift



those from the Triassic period have been

C. In the Triassic to Cretaceous periods vast quantities of river and airborne sediments were deposited, but only found here.



erosion has removed at least 1 km of overlying sediment and dug deep into the Carboniferous rocks below, to produce the present Pennine landscape.

D. Further uplift in early Tertiary times led to renewed erosion. During the last 20 million years

THE MISSING 280 MILLION YEARS

For the last 280 million years northern England has been an upland area on a continent which has drifted very slowly northwards. Vegetation flourished in warm times and animal life developed, as reptiles, birds and mammals evolved. However, because any sediments and rocks have been eroded away, there is very little evidence in this area to show what happened since the late Carboniferous period until the onset of the ice ages 1.8 million years ago.

GLACIAL TIMES

During the last 30 million years global climate has been cooling down, culminating in the development of huge ice-sheets in the last 1.8 million years.

Global temperature has fluctuated since then, resulting in many advances and retreats of ice sheets over Northern Europe. Ice sheets grew in cold times in high mountain areas and advanced into the lowlands. However, most of the evidence of early ice advances has been obliterated by later events.

The last glacial stage, called the **Devensian**, was at a maximum about 17,000 years ago and ice covered the high ground in the Otley area. As temperatures rose, ice melted and ice sheets became thinner. The thickest ice was confined to valleys in the final stages of the glacial period. It would have been possible to stand on The Chevin and look over glacial valleys, with ice moving down Wharfedale and Airedale and meltwater streams filling the valley floors with glacial sands and gravels. The picture on the interpretation board at Surprise View shows how the landscape of Wharfedale would have looked then.

By about 12,000 years ago, when the ice had melted completely, it left behind deposits of **glacial till** (boulder clay), which was sometimes washed away or modified by meltwater.

