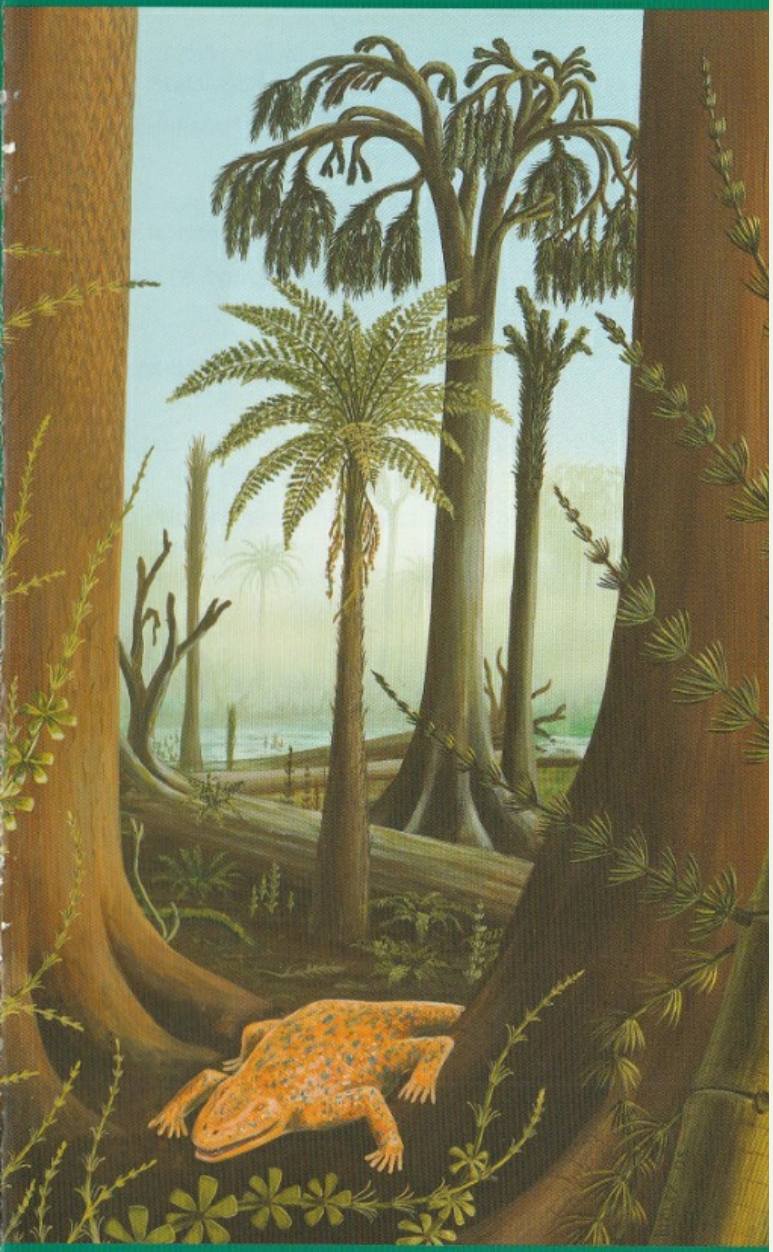
Roundhay Park
A Walk Back in Time



Roundhay Park 300 million years ago

THE ROUNDHAY PARK GEOLOGY TRAIL

Roundhay Park covers an area of around 700 acres of parkland, lakes, woodland and gardens, and contains an abundance of wildlife.

The Geology Trail has been developed by The Friends of Roundhay Park and The Leeds Geological Association.

Our aim is to introduce you to events which happened millions of years ago - when it all began!

All the locations are Regionally Important Geological Sites (RIGS - a national organisation to conserve geological sites).

Please respect the importance of these sites and do not damage them.

Each site is marked by a numbered stone showing the trail logo.

The total distance of the Geology Trail as described is approximately 4.8km or 3m.

Allow at least 1½ hours to cover the trail which mainly follows good footpaths but there are sections of steep or rough ground.

With the exception of sites 7 and 8, the trail is accessible for assisted wheelchair users in normal conditions. The route is less accessible following periods of wet weather.

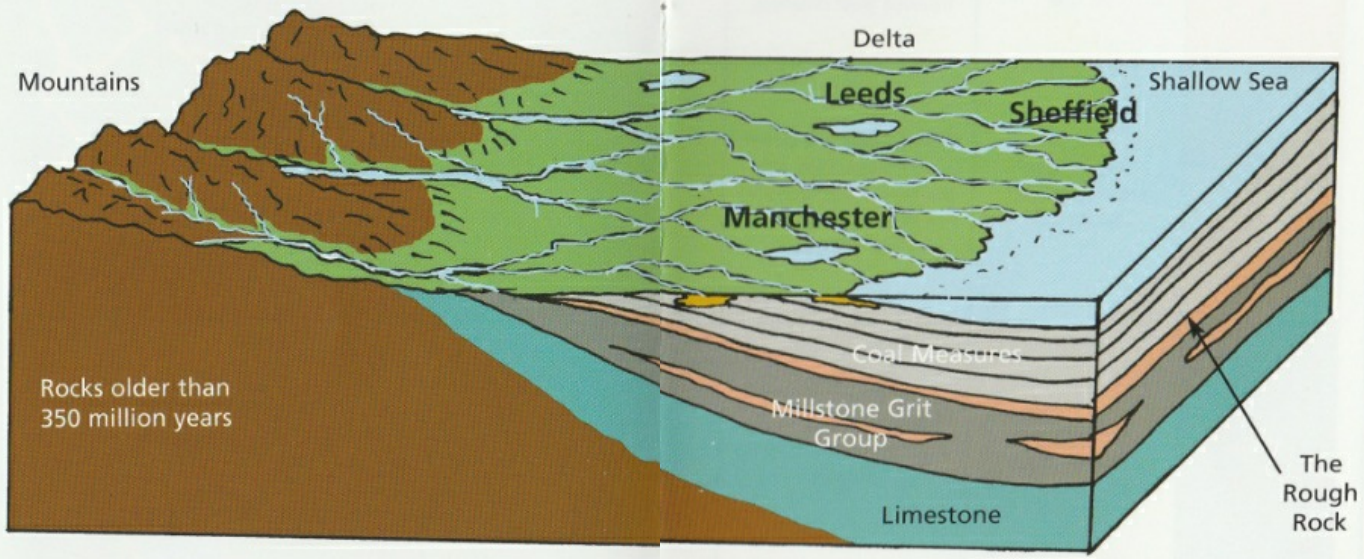
CONTENTS

MAP

SITE INDEX

ROUNDHAY PARK IN THE GEOLOGICAL PAST

350 million years ago, in what geologists call the **Carboniferous Period**, the land that now forms the north of England, was a flat coastal plain that lay across the equator. To the north, made up of land that now forms Greenland, Scotland and Scandinavia, stood a mountain range of Himalayan proportions. Heavy rains fed great rivers that flowed south from the mountains, to a shallow sea where limestone was forming.



Northern England 300 million years ago.

The rivers were eroding the mountains and carrying them away as sand and mud. On reaching flatter land and the sea the rivers slowed and deposited the sediment, creating a great delta that was slowly built out into the sea.

On top of the delta, in channels of faster flowing water, the rivers deposited coarse sands. During floods, layers of finer sand were deposited on the surrounding land as well. Lakes and lagoons, left when the floodwaters receded, were filled with dark mud. Occasionally the sea flooded the delta only for it to be rebuilt as the rivers washed down more sediment.

The buried sediments slowly hardened to form layers of **sandstone** and **shale** known as the **Millstone Grit Group**.

The sediments deposited in the final stage of the delta are what are seen today in Roundhay Park. The layer of sandstone known as the **Rough Rock** can be traced into Lancashire and South Yorkshire, showing how big the delta must have been.

By 325 million years ago, the delta had become established and plants grew on its swampy surface. In the hot, wet climate it soon became covered in forests of giant ferns, mosses and primitive trees. Dead plants fell into the swamps and turned to peat in the stagnant water.

As this part of the Earth's crust was sinking the forests and swamps were repeatedly flooded and buried under more layers of sand and mud.

The layers of peat became seams of **coal**, which, along with the sand and mud that had buried them, formed a group of rocks called the **Coal Measures**. While these conditions lasted for 25 million years, and allowed more than 2km of Coal Measure sediments to accumulate, it has taken man only 200 years to mine most of the workable coal from them.

Slow movements of the crust carried the land northwards from the equator. On its journey to its present position, other rocks formed on top of the ancient delta under quite different conditions. The land suffered many episodes of earth movements that folded, fractured and uplifted the rocks.

Eventually the overlying rocks were worn away and a small part of the delta emerged as the rocks we can now see in Roundhay Park. The rocks are a window on the past; a walk through Roundhay Park today is truly a walk back in time!

THE MILLSTONE GRIT GROUP IN ROUNDHAY PARK

Youngest ↓ Oldest

ROCK	DESCRIPTION	ENVIRONMENT
Gritstone The Rough Rock	Coarse sandstone made of angular grains of the minerals quartz and feldspar and rock fragments.	**River Channel:** A deep, fast flowing river. The angular shapes of the grains show that the particles have not travelled great distances.
Sandstone	Thin layers of medium grained sandstone.	**Flood Plain:** The lagoon has become filled with sediment. Sands deposited as rivers, flowing across infilled areas, flood.
Shale	Shale with non - marine fossils	**Lagoon:** Return to still water conditions as floods subside
Muddy Sandstone	Dark grey, fine grained sandstone in layers a few centimetres thick	**Lagoon:** Weak currents wash larger grains into the lagoon, possibly during times of floods.
Shale	Dark grey rock made of tiny particles of clay. The rock breaks into thin layers and is easily eroded. It contains several thin layers of marine fossils.	**Lagoon:** Fine mud settling in very still water. The rock is black because the water was stagnant and dead organisms buried with it didn't decay. The marine fossils show a time when the lagoon was flooded by the sea

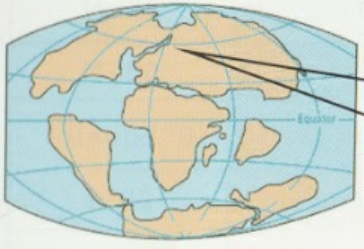
HOW THE CONTINENTS HAVE MOVED

0 million years ago.

The Present

The Atlantic Ocean is still widening while the Pacific Ocean shrinks.

100 million years ago.



Cretaceous Period

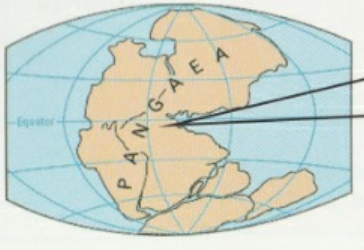
Gondwanaland has broken up. Europe breaking from North America.

200 million years ago.

Triassic Period

Pangea has broken into Laurasia and Gondwanaland. 'Britain' in the tropics.

300 million years ago.



Carboniferous Period

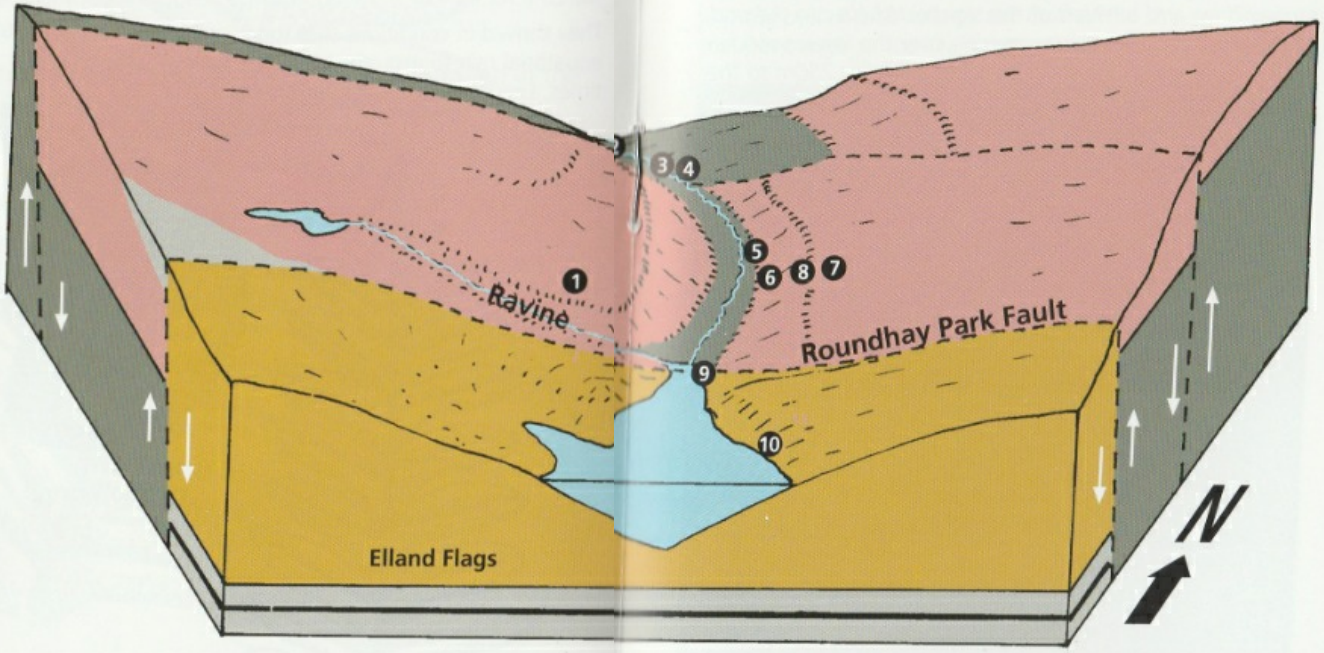
One 'supercontinent' called Pangea. 'Britain' on the equator.

GEOLOGICAL TIME SCALE

Ma = millions of years

Age	Geological Period	Latitude of Britain	Major Events in Life and in Britain	
0 Ma	Quaternary	55° N	Ice Age	Humans
2.0 Ma	Tertiary		Uplift of land	Rise of mammals
65 Ma				Major Extinctions
100 Ma	Cretaceous	40° N	Shallow seas	Age of the Dinosaurs
200 Ma	Jurassic	20° N	Shallow seas	
	Triassic	15° N	Hot, dry deserts	
250 Ma				Major Extinctions
300 Ma	Permian	10° N	Hot, dry deserts	
	Carboniferous	0° Equator	Swamps & shallow seas	
400 Ma	Devonian	20° S	Hot, dry deserts	
	Silurian		Continents collide	
500 Ma	Ordovician	60° S	**First life on land**	Life only in the seas
	Cambrian		Deep Oceans	
545 Ma			**Appearance of animals with shells**	
600 Ma	Precambrian	'Britain' was part of several small continents		
			1800 Ma First animals	
			Primitive life	
4600 Ma	Formation of the Earth		**3800 Ma First life**	

THE GEOLOGY OF ROUNDHAY PARK



Major Faults and their directions of relative movement

Sites		Rock Types	
10	Elland Flags	Sandstone and mudstone	Coal Measures 325-300 Ma
		Shale and coal seams	
6,7,8	Rough Rock	Gritstone and sandstone	Millstone Grit Group 360-325 Ma
2,3,4,5		Shale and sandstone	

Stone Quarrying

The Rough Rock and Elland Flags have both been important building stones in Leeds, as well as more distant places.

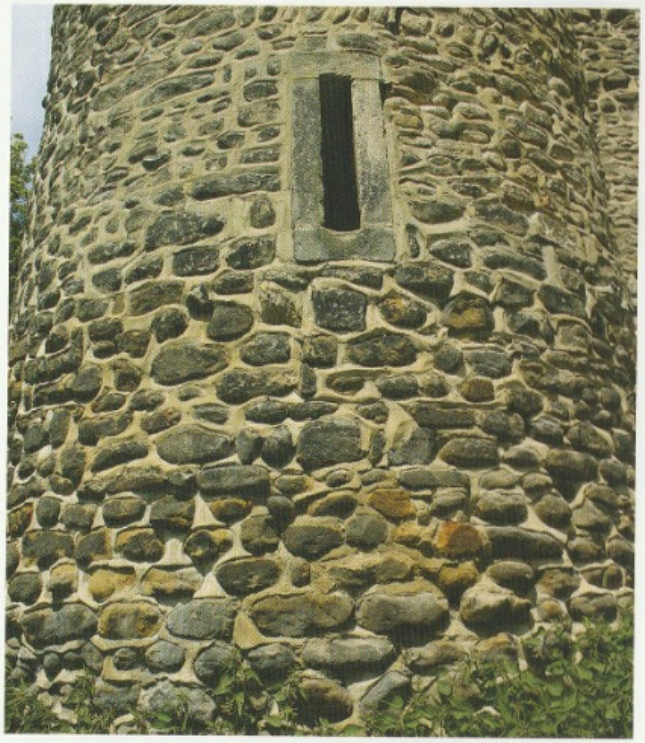
The Rough Rock, because of its strength and resistant character, was often used for engineering works. As well as Scouts Quarry (Site 7) there are small quarries on both of the golf courses.

The Elland Flags split naturally into slabs a few centimetres thick and this property meant they were primarily worked for paving stones. Offcuts were widely used as building stone and many examples of this can be seen locally. While a few small quarries worked the Elland Flags within the boundaries of the Park, the folklore tale that the flooding of such a quarry formed Waterloo Lake is not true.

1 AN ICE AGE

from The Mansion 650m

The trail starts at the Mansion Car Park. Go down the wide tarmac drive and turn left at the signpost/shelter to the end of the lake, into the ravine, crossing over the lower wooden bridge. Straight on the rhododendron path for 250m to the Castle Folly.



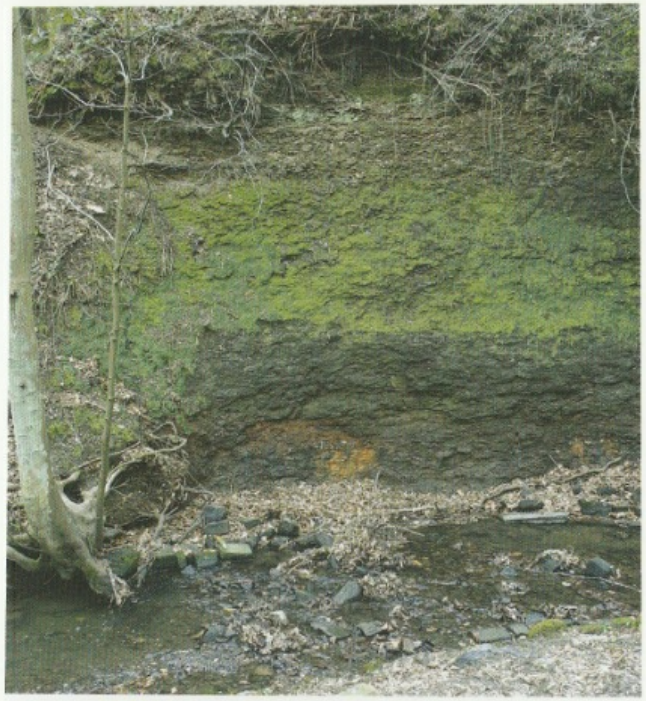
The lower parts of the Castle walls that face downhill are built of rounded boulders of **sandstone**. They are similar to sandstones near Otley in the Wharfe Valley and were carried here by the ice sheets that spread across Britain around 300,000 years ago and were dropped when the ice melted. During the most recent glaciation, which ended approximately 15,000 years ago, ice didn't reach as far as Roundhay Park.

Proceed in the same direction through the small arches and join the main path from the left. At the 'crossroads' take the left hand path along the top of the gorge for 600m - (beware of the very steep drop on the right hand side of the path).

LAGOONS
from 1 to 2 - 740m

2

Take a sharp right turn down an unmade sloping path to join the path which follows the flow of the stream. Cross the first bridge to the shale outcrop.



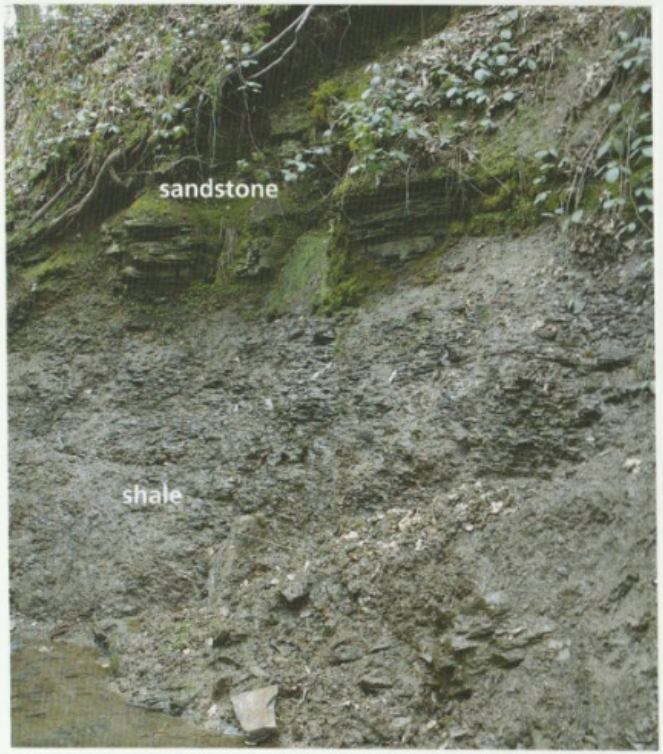
The steep sides of the Gorge are due to them being made of **shale** that is soft and which the stream can easily erode. Shale is made of microscopic particles of mud that will only settle in very calm water. Most of the fossils in the shale are of non-marine animals showing that it was probably a lake but thin bands of marine fossils show that the sea occasionally flooded it. The dark colour of the rock is due to the water in the lake being stagnant which meant that dead organisms, which sank with the mud, didn't decay. The orange stain is caused by water, rich in dissolved iron, leaking to the surface. When it meets the air the iron turns to 'rust'.

Follow the path in the same direction as the flow of the stream.

3

FLOODING
from 2 to 3 - 220m

Continue to follow the stream, crossing over 8 bridges until you reach a 'lay-by' alongside the path, shortly before it starts to rise uphill.



Shale forms the lower part of this outcrop but above it are paler, more thickly bedded layers of **sandstone**. Note that the layers here are in their original, horizontal position.

Sandstone is made of bigger grains than shale and show that stronger currents were carrying sediment into the lake. This might have been at a time of higher rainfall.

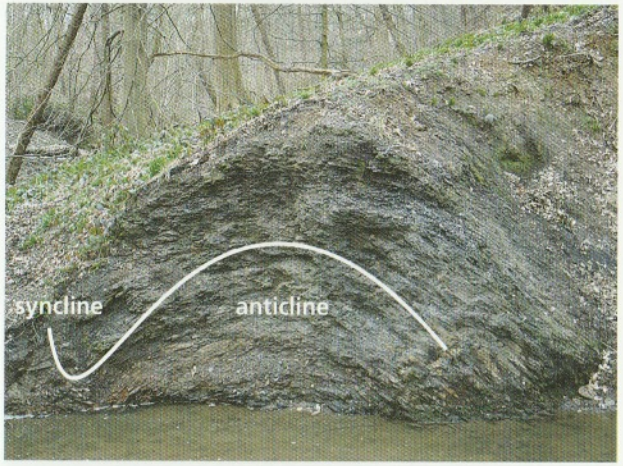
The stream is eroding the soft shale and undercutting the harder sandstone, which is why the layers project from the cliff.

Site 4 is adjacent to site 3 and can be observed from the 'lay-by'.

FOLDING
3 is next to 4

4

From the same position - look to your left.



Although this site is very close to site 3 notice the difference in the rock layers; the shale here has been folded. The upward facing fold is called an **anticline**, the downward one a **syncline**.

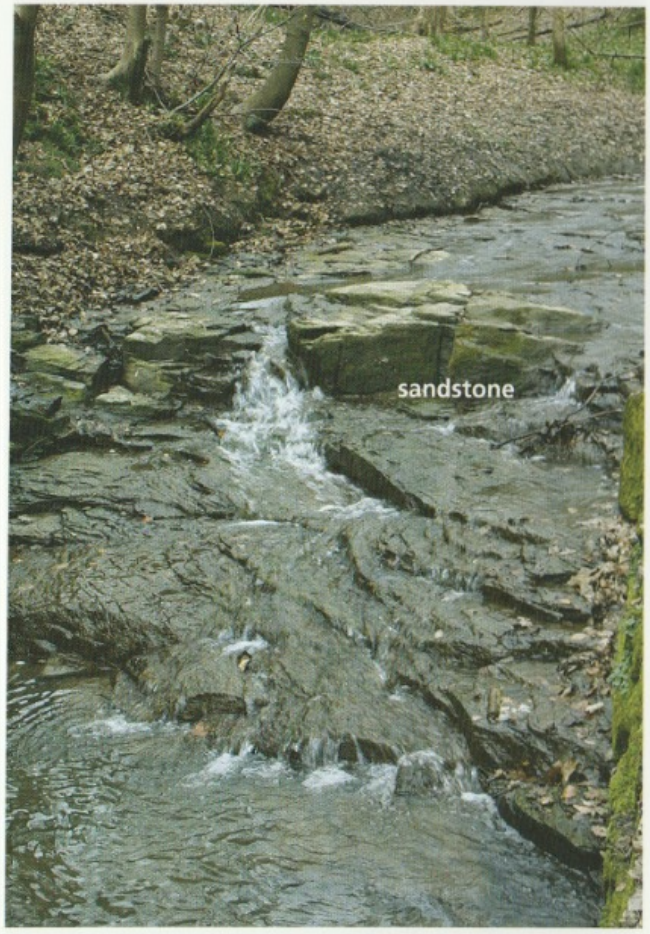
The folds were formed by powerful earth movements that affected the area long after the rocks had been buried. The folds can be traced in the streambed above and below this site and they are associated with the fault that crosses the Gorge close by.

Follow the path in the direction of the stream flow.

Along this stretch there are benches for the weary and in Spring/Summer some magnificent displays of English bluebell, wild garlic and wood anemone.

5 WATERFALL
from 4 to 5 - 320m

After 320m there is a bench on your left and opposite is the marker for site 5. Look into the stream - to the right.



A thin layer of fine-grained **sandstone** within the shale causes this small waterfall. Sandstone is harder than shale so the stream isn't able to wear it away so quickly.

This is the same sandstone as the one seen at site 3. Here it is at a lower level because it is on the down throw side of the fault that crosses the Gorge between sites 3 and 5.

Proceed along the path, following the flow of the stream.

SPRINGS 6
from 5 to 6 - 70m

After 70m you will come to springs on your left. The spring on the right which discharges into a stone bowl is known as the Dog Mouth Spring.

Two springs bubble out through layers of sandstone to make 'Dog Mouth Spring'.

Sandstone is porous and absorbs water falling on it. Below the level of this path the sandstone rests on the shale seen at previous sites. This stops water soaking down any further; instead it seeps sideways to the surface to form the springs.

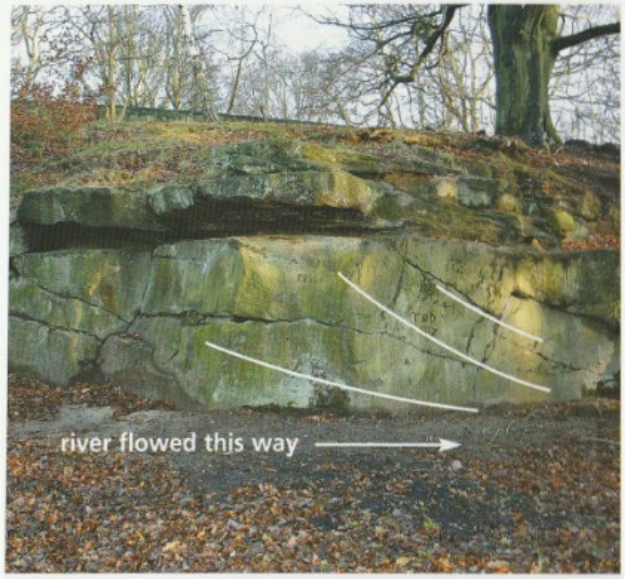
This sandstone is the base of the **Rough Rock** which will be seen at site 7 and was formed by a river. This shows that the lake in which the shale had been deposited was now completely filled with sediment.

Again follow the path in the same direction as the flow of the stream.

After 30m there are steps to your left. Go up the steps and follow to a rough, unmade path up the hillside.

7 FAST FLOWING RIVERS
from 6 to 7 - 170m

Carry on up this path, passing site No. 8 and the path coming in from your left, to the brow of the rise, to Scouts Quarry.



Stone from this quarry was used to build the walls around the Park. The rock is **gritstone**; a coarse sand with small pebbles. It is called the **Rough Rock** and is typical of the thicker sandstone layers in the **Millstone Grit Group**. The gently sloping lines in the rock were once the faces of dunes that formed on the bed of a large, fast flowing river. They slope in the direction the river was flowing; in this case it was to the south.

The steeper, curved lines on some rock faces are pick marks made when the quarry was being worked.

Look carefully in this quarry and you will find a small **fault** where the rock layers have broken and moved vertically about 50cm.

The Rough Rock can also be seen in the Ravine on the other side of the Gorge. Being a hard rock it forms a protective cap to the soft, easily eroded shale that lies below it.

Go back down the path and retrace your steps to site 8.

YORKSHIRE GRIT
from 7 to 8 - 60m

8

Site 8 - the Large Boulder is on your left.

The boulder of **gritstone** is a waste block from the quarry. The white pebbles in it are pieces of the mineral **quartz**. The large sizes (1cm to 2cm) and angular shapes of most pebbles show that strong currents have carried them but only over a relatively short distance. Rocks that today occur in Greenland are their likely source.

The pebbles in this block allow it to be matched to the layer in the quarry it came from.

Return to the main path via the steps and turn left towards Waterloo Lake.

Do not turn left or right off this path.

9

FAULTING
from 8 to 9 - 240m

Stay on the main path with Waterloo Lake on the right.

At marker 9, look back to the head of the lake.

The Gorge suddenly widens at this point to form the wide, shallow sided valley that has been flooded to form Waterloo Lake. The rocks under Waterloo Lake are not shale but **sandstones** of the **Coal Measures**. They are harder than the soft shale that forms the Gorge, so the stream has not been able to erode them so quickly resulting in the valley sides eroding more evenly. The sudden change of rock is due to a **fault** that crosses the valley at the head of the Lake. The rocks to the south of the fault have been dropped down by 150 metres and are approximately 1 million years younger than those in the Gorge. This is the **Roundhay Park Fault** and it forms the northern boundary of the Yorkshire Coalfield.

Follow the path with the lake on your right - there are enough benches to cater for sore limbs!

SANDBANKS
from 9 to 10 - 775m

10

After 775m you will have seen lots of birdlife and arrive at the last site on the trail.

Scale 1cm divisions

The rock is **sandstone** belonging to the **Elland Flags** of the **Coal Measures** and is the youngest rock in the Park. It lies at the lowest point on the walk and the rocks here are on the downthrow side of the **Roundhay Park Fault**. Ripples, formed by wave action and the marks left by burrowing worms can be seen on the tops of the layers (see inset). The sand was deposited in shallow water when seas flooded the ancient delta. **The Elland Flags** are an important local building stone and were used to build The Mansion House and for filling the wire baskets that support the sides of the path around the Lake.

This completes the trail and we suggest that you carry on around the lake to Lakeside Café in order to recharge your batteries!

From Lakeside Café carry on up the tarmac drive, past the shelter and Barrans Fountain, back to the Mansion.