

Rock in the city

A short city stroll around Sunderland, taking in Mowbray Park

A Magnesian Limestone Geotrail. Walk 2

A walk on the Magnesian Limestone Plateau

This walk is one of five self-guided trails that help you to explore east Durham, South Tyneside and Sunderland and find out how the geology has influenced the area's natural habitats and the lives of local people.

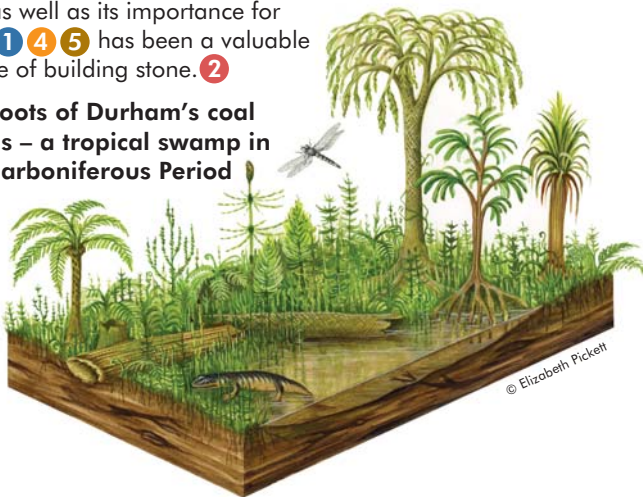
Together the walks offer a fascinating overview of the many processes that shaped the landscape you see today.

An introduction to the area's geology

The numbers in circles show which walk is best for seeing a particular geological feature.

310 million years ago, in the Carboniferous Period, this area was part of a large continent that lay across the equator. Low lying tropical swamps covered the land. Dead trees and other plants built up as a layer of peat, which was then buried under layers of sand and mud. Eventually the peat hardened to form coal seams and the sand and mud became sandstone and shale. This sequence of rocks is known as the 'Coal Measures' and as well as its importance for coal 1 4 5 has been a valuable source of building stone. 2

The roots of Durham's coal seams – a tropical swamp in the Carboniferous Period

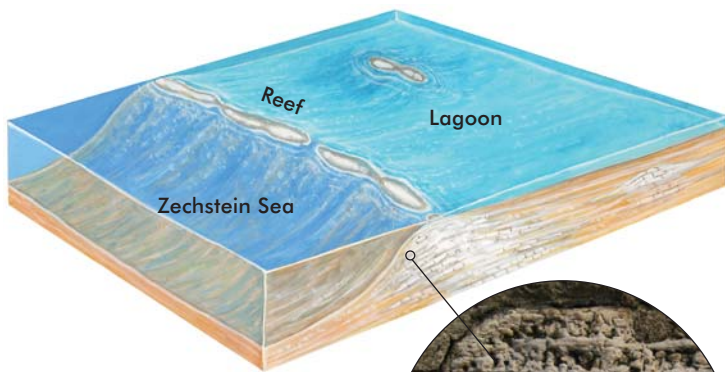


About 300 million years ago the land moved slowly further north of the equator and the climate became hotter and drier. This area became a barren desert covered by sand dunes. The remains of these dunes, the 'Yellow Sands', are quarried today for building sand. 5

A large part of the desert lay beneath sea level and around 260 million years ago, in the Permian Period, water from the surrounding ocean flooded it to create a shallow inland sea, known as the Zechstein Sea. Over the following several million years the sea level rose and fell several times, causing the Zechstein Sea to periodically dry up.

A reef formed a barrier running roughly in a north-south direction, separating a shallow lagoon to the west from deeper water to the east. The reef can be seen today as a

number of hills in the area, including the Tunstall Hills 3 and Beacon Hill near Seaham. 4 A large variety of animals lived on and within the reef. Tiny fragments of shell and skeletal remains built up as lime-rich mud on the sea floor. It is this limy mud that eventually became limestone. In places fossilised shells can still be seen in the rock.



Above: The Zechstein Sea, in which the Magnesian Limestone was laid down.

Right: Unusual textures formed in some of the limestones. You'll see this used in many of the buildings and walls of Sunderland. This example is from the wall at point 1



During periods of falling sea level, the hot arid climate caused the sea water to evaporate, making it much saltier. Salt minerals known as evaporites built up on the sea floor. Thick salt deposits still exist deep beneath the surface further south, but in this area they have dissolved, causing the rocks above them to collapse. 1 4

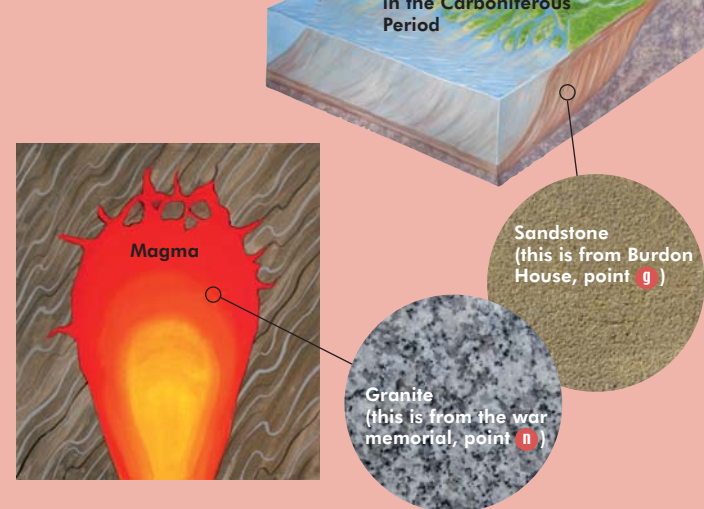
This area continued to drift north for 250 million years until it reached where it is today. We do not have any record of the geology of the area during that time as any rocks formed have been removed by the work of rivers and seas. Some of these 'missing' rocks have been quarried elsewhere and brought into the area for building stone. 2

Over the last 2.5 million years the climate alternated between colder periods ('ice ages') and warmer periods. At times, ice sheets up to 1km thick covered County Durham and the North Sea. The ice finally melted about 15,000 years ago. The action of the ice and meltwater were largely responsible for shaping the landscape you see today. Rivers and seas continue to wear away the land, deepening valleys and further altering the dramatic coastline. 1 3 4 5

A city built on geology

Around the streets of Sunderland, you can see examples of local stone, stone from elsewhere in the UK and also from other parts of the world. Like all rocks, these building stones can be categorised into one of three main groups: sedimentary, igneous and metamorphic.

Sedimentary rocks form at the Earth's surface by the accumulation of fragments eroded from pre-existing rocks or the remains of organisms such as sea creatures and plants. These build up in layers and after millions of years eventually harden into rocks such as sandstone, limestone and coal. The local rocks described opposite – like the Coal Measures and the Magnesian Limestone – are sedimentary rocks. Sandstone and limestone can be seen in many Sunderland buildings.



The word **igneous** comes from the Latin word for fire and describes rocks that form when molten rock (magma) cools and solidifies, either underground (eg granite) or at the Earth's surface (eg basalt). To a geologist, the term granite refers to a rock of a specific composition and grain size, but to a stonemason or architect it is a broader term, used to describe a range of crystalline igneous rocks. The decorative 'granites' used in Sunderland's buildings have been imported from other parts of the UK and even abroad.

This third rock type takes its name from the Greek for 'change of form'. Marble and slate are **metamorphic** rocks which formed when limestone and shale were altered by heat and pressure in the Earth's crust. Welsh slate became a common roofing material in the 19th century, when the development of the railway network enabled slate to be transported further afield.

More geology to see in and around Sunderland

Sunderland Museum & Winter Gardens



When you finish the walk it's well worth calling in at the Museum. Discover more about Sunderland's fascinating geological story in the 'Lost Worlds' gallery and ponder our tropical Carboniferous past amongst the rainforest plants of the Winter Gardens. Although the plants you see hadn't evolved back then, the garden gives a sense of one of Sunderland's many long-vanished worlds. seeit@sunderland.co.uk Tel: 0191 553 2323

Further afield...

There are many other interesting building stones, rock exposures and geological features to be seen elsewhere in the Sunderland area, including along the Roker-Seaburn seafront and at South Hylton. These areas are described in the book 'Bedrock and Building Stones: Geology exposed in the City of Sunderland' by Dr Andy Lane. Find out more at www.rocksofthenorth.co.uk

Claxhough Rock, South Hylton GR: NZ362574

Cannonball concretions Roker GR: NZ407597



The Limestone Landscapes Partnership is working with many different people to conserve the landscape, wildlife and rich heritage of the Magnesian Limestone and to enable communities to learn about, enjoy and celebrate their local area. This walk is one of five we have produced which introduce the unique geology of the Magnesian Limestone Plateau.

- 1 Marsden cliffs and Souter
- 2 Sunderland City Geotrail and Mowbray Park Sensory Trail
- 3 Tunstall Hills
- 4 Nose's Point, Seaham
- 5 Coxhoe



Much of the land along this route is owned by Sunderland City Council. To report any issues on this route please visit www.sunderland.gov.uk

This project has been coordinated by Groundwork NE & Cumbria; Changing Places, Changing Lives – one green step at a time. Find out more at www.groundwork.org.uk/northeast or follow us on Facebook and Twitter.

We would like to thank Sunderland City Council, Andy Lane and the Sunderland Antiquarian Society for their help.



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Limestone Landscapes

Making a positive difference to the unique environment of the Magnesian Limestone area



Walk information

Discover some of Sunderland's buildings and the rocks they're made from 2 miles/1.25km

A mainly level route on good surfaces (pavements and tarmac paths). There's a gentle climb to the top of Building Hill in Mowbray Park and steps at the Civic Centre and the Minster, which can be avoided if necessary.

P Plenty of city centre parking.

B Sunderland is served by plenty of buses and trains, and both the rail and bus stations are near to the start of the walk.

C Plenty of cafes, coffee shops and pubs

M Sunderland Museum

Directions

1 From the Museum, turn right and cross the Borough Rd at the lights to Fawcett St. **a** Walk all the way to St Mary's Church at the end of the road on the left. **b**

2 Turn left at the end of the church building and left again to walk around the back into Pann Lane **c**. Where lane splits, keep right to walk down narrow alley. Out on High Street, turn right.

3 Walk along pedestrianised section of High Street **d**, passing West Street on the left. Keep on until you see the distinctive narrow building ahead to the left (the 'Londonderry' pub). Walk down to the left side of the pub, cross the road ahead at the zebra crossing and turn right.

4 Turn left before the row of buildings, then right along a lane that brings you to the back of the Minster Church. **e** Turn right, following church wall on left. Back at main road, turn sharp left through gateway into church grounds. At church turn right and follow path around the building. At far side of church turn right to leave the grounds and then right again down a flight of stone steps to a pedestrianised street. Turn left.

5 Cross the road ahead at the lights. Keep straight on, following an old stone wall on your left **f** (Green Terrace). At the end of the street turn left. Walk along this road for 450m back to the crossroads with the Museum on the far corner. Turn right, crossing

the road at the lights and walk down the right side of the road straight ahead (Burdon Road) **g**. Follow this road for 300m to the Civic Centre and a road cutting **h**.

6 Walk under the footbridge and after about 20m look for an exposure of rock on the corner **i** with steps on the right. Go up the steps, back under the footbridge and keep left to cross the bridge into Mowbray Park. Turn right and take the left fork, heading towards the overgrown rock face. **j** Turn right then keep left to climb up Building Hill, heading towards a statue. **k**

7 Keep on, following the path at the edge of the quarry, and back downhill at the far side as the path bears left. At the lodge **l** turn left back to the quarry. The path bears right to the bowling green. Turn sharp left back to a good exposure of the quarry face. **m** Take next right past a small sculpture and then next left up to the monument on top of a rise. **n**

8 Turn back. At the path junction turn left, then left again down to the park gates. Don't leave the park, but turn right, then left across bridge over old railway cutting. Keep straight on, passing statue of John Candlish. Turn left at T-junction to war memorial **o** then right and back to the museum.

a A city of contrasts

Sunderland has a rich geological heritage, reflected in its buildings, streets and parks. The city is built on Magnesian Limestone, but the rock most commonly used in the grand 19th century buildings is a yellowish sandstone from the 'Coal Measures' to the west of Sunderland (see overleaf). Red sandstone is also common here – this has probably come from St Bees on the Cumbrian coast or Dumfriesshire. You'll also see other materials brought from further afield in the UK and even abroad: slate, brick and granite. Wartime bombing ravaged Sunderland, destroying many historic buildings, and with modern redevelopment in streets like this many more non-local building materials have been introduced.

b St Mary's Church – hidden stone

The front is local sandstone but Magnesian Limestone has been used high up in the north-facing walls and round the back of the church on Pann Lane. These walls were originally hidden by surrounding buildings, so would not have been clearly visible to passers by.

Construction of the church began in 1830, so the rough limestone could well have been sourced from Building Hill in Mowbray Park (**1**) as a cheap, readily available material.



c Pann Lane – salty connections

The long-gone Sunderland industry of salt-making is recalled in the name of Pann Lane. As early as 1349 salt was being made from seawater along the banks of the River Wear. In 1589 salt-making here expanded, with seawater being heated and evaporated in iron vats known as 'panns', using local coal as fuel. Sunderland became famous for exporting both coal and salt.

At the end of Pann Lane look out for a grand tiled frontage in the wall on the right – all that remains of The Three Crowns Pub, which closed in 1959. These beautiful tiles are made of 'faience', a special type of tin-glazed pottery.

d Deep down rock

The distinctive green-grey cladding on the front of Marks & Spencer is from deeper in the Earth than most rocks you'll ever see! It is an unusual metamorphic rock (see panel) known as 'serpentinite'. Its origins lie in the 'mantle', which starts between 10 and 30km below the Earth's surface. The rock you see here took millions of years to reach the surface and was altered by water to become serpentinite.



e Sunderland Minster

As you approach the Minster look at the wall ahead and you will see it is made of blocks of local Magnesian Limestone. Although a church has stood on this site for over 1,000 years, very little remains of early buildings. The church was largely rebuilt in the 1930s, as a result of damage caused by coal mining subsidence, and the stone used in the restoration was a limestone from Rutland. This formed 170 million years ago, in a warm shallow sea, and contains shelly fragments.

f A wall of note

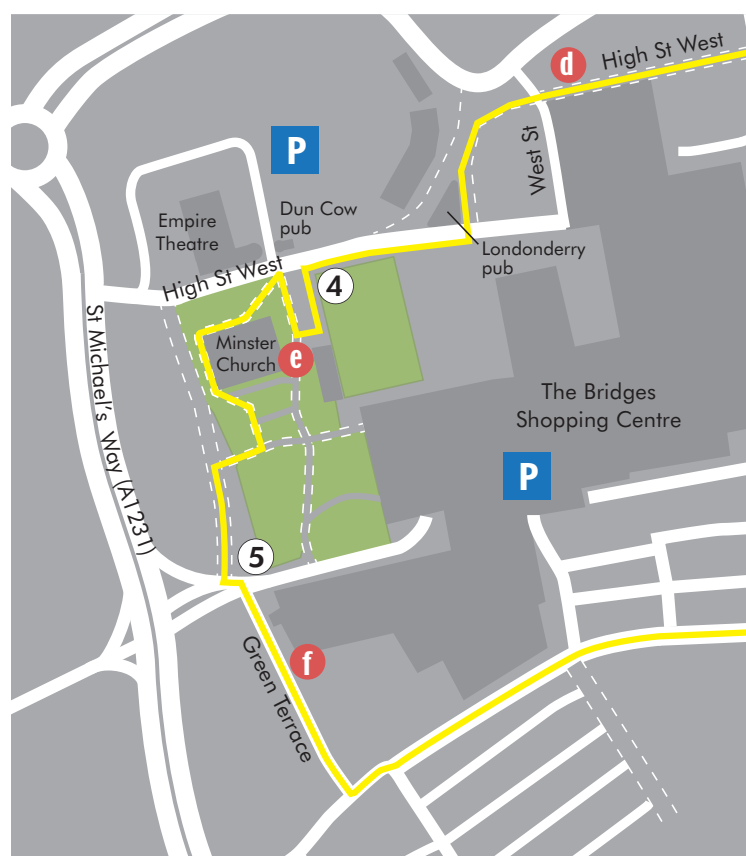
This wall dates from the mid 1700s and once enclosed houses of the old village of Bishopwearmouth. By now you will recognise the Magnesian Limestone from which it is built!

g Different rocks

Burdon House, which was built in 1916 for the North Eastern Railway Company, is a good place to see the contrast between typical sedimentary and igneous rocks. Although most of the building is made of the same local sandstone as many of Sunderland's older buildings, near the base is a speckled grey igneous rock, which is made up of light and dark minerals. Contrast these tightly interlocking crystals with the sand grains of the sandstone; these reflect their very different origins – in a deep magma chamber or sandy river deltas.

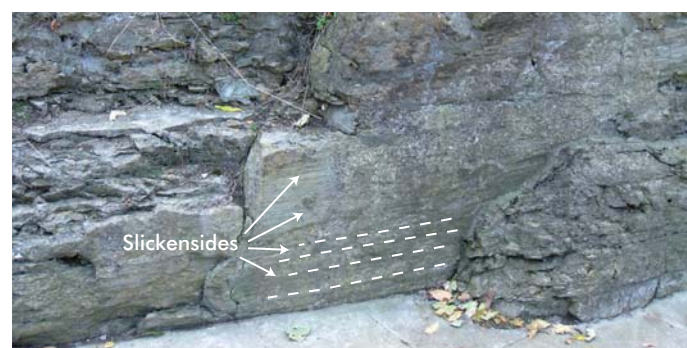
h Bedded down

This road cutting reveals a good section through the Magnesian Limestone. Look across the road and below the wall you can see roughly horizontal layers in the rock face. These are known as 'beds' and they formed when layers of soft lime-rich mud built up on top of one another in the ancient Zechstein Sea. The mud eventually hardened into limestone, preserving some original features like these beds.



i Rocks on the move

At the bottom of the steps to the Civic Centre there's a natural rock face. Look for the smoother vertical surface (see below). This is evidence of a 'fault', a fracture along which rocks have moved past each other. You can see and feel horizontal scratches and grooves ('slickensides') on the surface, which tell us the direction of movement.



j A local source of stone

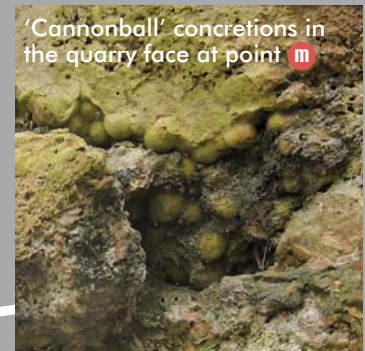
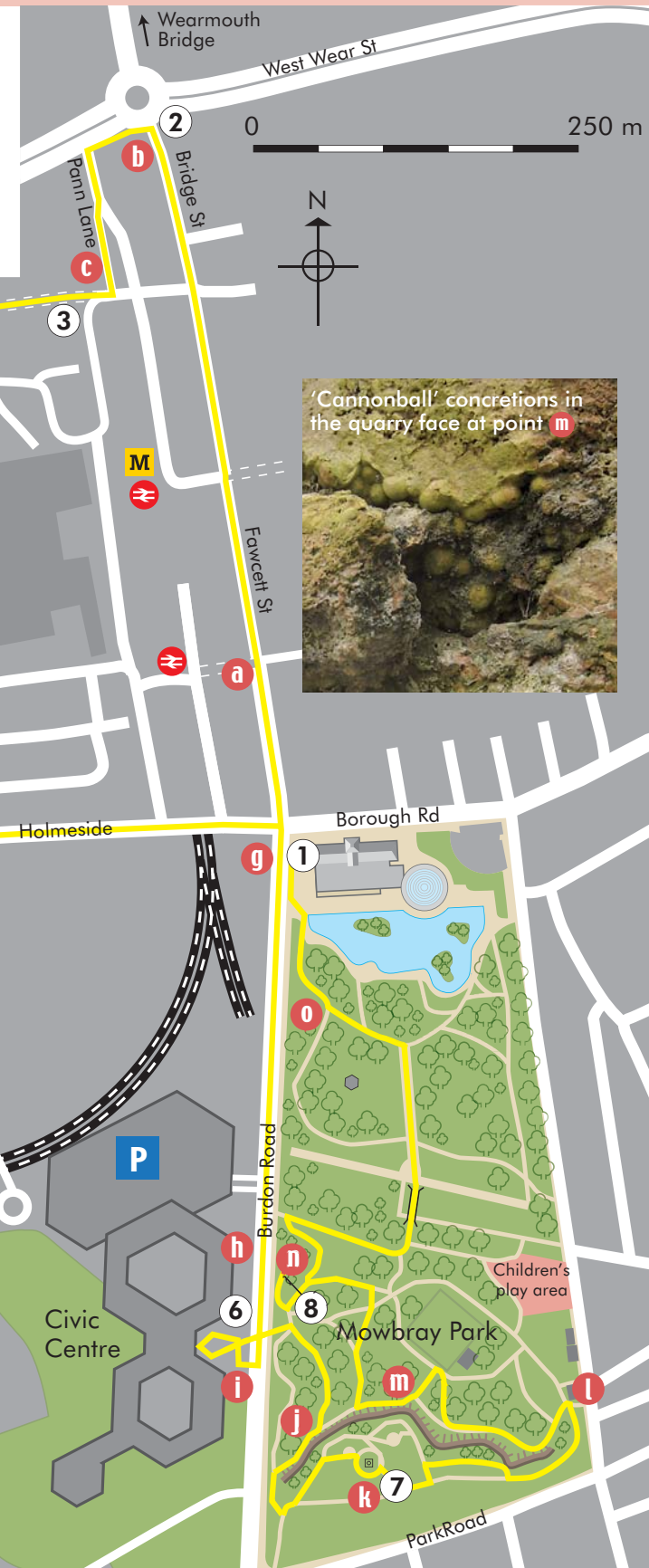
The rock face is the remains of an old Magnesian Limestone quarry that was here long before the park was created in 1857. Much of the limestone you have seen in buildings on the walk will have come from here. The grassy mounds you have just walked through are what remains of the old spoil heaps.

k View to a reef

As you climb to the top of Building Hill you're walking through geological time, from older to younger rocks. It's impossible to know exactly how much time this represents but it's probably tens of thousands of years. At the top is a statue of General Havelock on a grey granite plinth. From here you have a grand view. In the distance to the south-west you can see the Tunstall Hills; these are part of the barrier reef (see geology introduction overleaf) and can be visited on Geotrail Walk **3**.

l South lodge

Built in 1856, the cornerstones and door and window surrounds are sandstone, while the walls are again locally quarried Magnesian Limestone.



m Close up

Where the path meets the old quarry face you can see bedding layers (see **h**) and intriguing textures called concretions, including 'cannonballs'. These structures formed as a result of complex chemical reactions in the limy mud, a process still not fully understood by geologists.

n A Magnesian Limestone rockery

In the rockery around the Jack Crawford monument are fine examples of Magnesian Limestone. Look out for a range of unusual patterns in the blocks, including more cannonballs. Some of the concretions have been cut through, showing their internal structure with radiating patterns.

o Lest we forget

The war memorial is a soaring column of pale grey granite from Cornwall. Around 280 million years have passed since it crystallized from molten rock. The new memorial wall is also made of pale granite. The rock is made up of three main minerals: quartz (glassy grey), feldspar (white) and mica (dark).