The Geology of the Peak District National Park

KS2 : Teachers' Information and worksheet

Introduction

Learning objective

To know about the different types of rocks in the Peak District

Curriculum link

Science: Rocks (year 3)

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock

Science: Scientific Enquiry

- Researching using secondary sources

Science: Working Scientifically (lower key stage 2)

- Using straightforward scientific evidence to answer questions

Science: Working Scientifically (upper key stage 2)

- Identifying scientific evidence that has been used to support or refute ideas or arguments

Geography: (key stage 2)

- Name and locate counties and cities of the United Kingdom, geographical regions and their identifying human and physical characteristics, key topographical features (including hills, mountains, coasts and rivers), and land-use patterns; and understand how some of these aspects have changed over time.
- Understand geographical similarities and differences through the study of human and physical geography of a region of the United Kingdom, a region in a European country, and a region within North or South America.

Wider links:
Cultural capital – National Parks and the wider countryside of the UK is a valued cultural asset that millions can enjoy and get benefits from.

UN Sustainable Development Goals: 15 Life on land: Protect Biodiversity and Natural Habitats

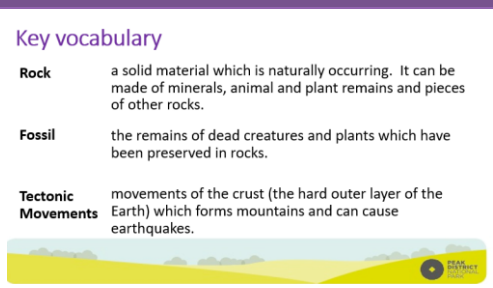
Overview

This session will introduce the main rock types and major landscape features of the Peak District National Park. There is a short introduction on the three major rock types, though students would benefit from having some prior learning about rock types and their formation. There is also a brief overview of how the local rocks have been deformed and uplifted since their deposition to give the outcrops which we see today.
It would be advantageous if learners could have access to a range of rocks and fossils during the session.
The final two slides can be use as stimulus for classroom discussion or further group/independent research with a focus on how rocks and fossils change over time and require conservation, just like other natural world features.

Presentation Slides

Slide 2

Discuss the vocabulary before revealing the definitions.



Slide 3 - 5

A chance to recap or introduce the three main rock types.

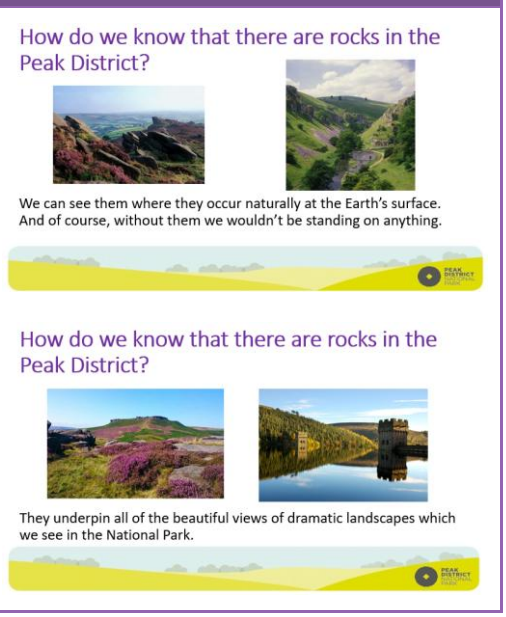
Sedimentary rocks are the fragments of other rocks which have been weathered and eroded and then deposited. The fragments (grains or sediments) are then cemented together with mineral deposits and compressed. Sediments are generally deposited in water.

Igneous rocks are formed when molten rock (magma) cools. If the molten rock reaches the surface before it cools it is called lava. As the magma cools mineral crystals are formed. The slower the rock cools the larger the crystals grow.

Metamorphic rocks form when a previously formed rock is subjected to intense pressure and sometimes heat. The pressure and heat causes the rocks to change chemically. Usually, there is no melting of the original rock.

Slide 3 - 5

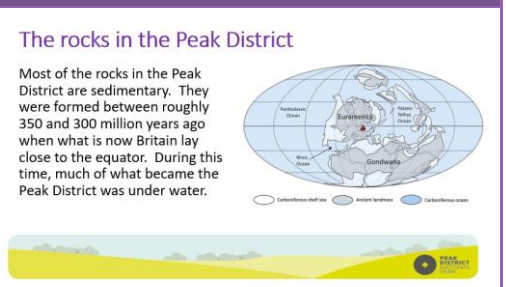
Discuss the shape of the landscapes formed by the rocks and how rocks are used in the built environment for building stone, walling, etc
It's important for children to realise that rocks are everywhere below the ground surface – this is called bedrock.



Slide 6

Igneous rocks are only a very minor Peak District rock. They are only seen at the surface in a narrow band between Buxton and Matlock.

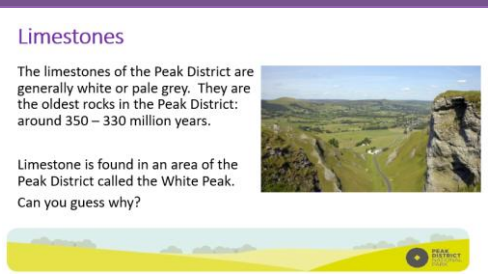
Much of the Peak District rock sequence is Carboniferous in age (see the end of the notes for a geological timeline). During this time, there were only two huge landmasses in the world – Euramerica (which became North America, northern Europe and Greenland) and Gondwanaland (which became much of the current southern hemisphere continents). The image shows a palaeogeographic reconstruction of the landmasses during the early Carboniferous period. Between the two continents was a shallow tropical sea which was full of life.



Slide 7 - 8

Limestone is one type of sedimentary rock. It is generally composed largely of calcium carbonate which comes from the shells and skeletons of sea creatures which have died and settled to the sea floor. Over millions of years the shells and sediments are compressed and cemented together (with mineral deposits) and become rock.
If plant material accumulates and is compressed, coal is formed. The carboniferous period is so named because this is the age of rocks where most of the world's coal is found.

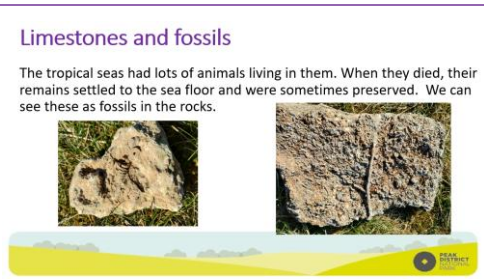
Question - The White Peak gets its name from the white to pale grey rocks which are seen here, in contrast to the Dark Peak which is formed in sandstones. The White Peak covers the central and southern area of the Peak District.



If the shells and skeletons of creatures are preserved either wholly or in pieces they are called fossils.

Common fossils in Peak District limestone are crinoids (like modern day sea lilies), corals (often forming fossil reefs), brachiopods (like modern day lamp shells), bivalves (like modern day clams, oysters and mussels) and gastropods (like modern day snails).
Fossils of vertebrates can also be found.

These photographs show samples of Peak District limestone, both containing fragments of crinoids. When preserved intact (if the crinoid skeletons are covered in sediment shortly after the animals die) then the fossil remains look like stacks of polo mints. Usually, however, the individual discs are separated from each other and scattered by movement of the seawater before they can be covered by sediment and preserved, as seen in the photo on the right.



Slide 9 - 10

These are approximately 330 – 300 million years old.
By this time there had been some tectonic uplift of the land and huge mountains lay to the north of what became the Peak District. A massive river system, bigger than the Amazon river, flowed from what is now Scotland and Norway south towards the Peak District area. This carried huge quantities of sediment from the mountain area into the lower lying land to the south. This sediment was deposited in a massive delta as the river slowed when it met the sea.

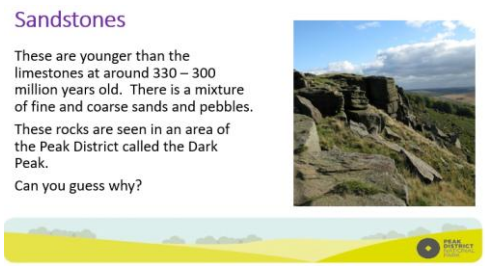
All of these sediments were deposited on top of the existing limestones – hence we know that they must be younger than the limestones.

Question – The Dark Peak is so called because of its dark soils which are peat rich and are a characteristic of the underlying sandstone and gritstones.

The sandstones and gritstones form a horseshoe shaped area around the eastern, northern and western areas of the Peak District.

The sandstones are interbedded layers of sandstones, silts (very fine sand), and mudstones, and show how the rivers changed course over time and sometimes built sandbanks. They also preserve evidence of huge underwater mudslides.

Question - The sandstones in the Peak District are often referred to as “gritstone” – this is not a geological term but an informal term for coarse sandstones which often have small pebbles in. It is the gritstones which were used to make millstones as the coarse grains were great for grinding the flour.



Slide 11

Shale is a very fine grained sediment formed largely of mud.

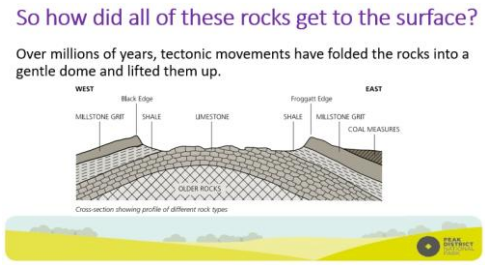
Question – As the sediment is so fine it often only settles out of the water *after* the larger sand grains, hence it is often deposited from very slow moving water such as in lagoons and lakes. In the Peak District sandstone and shale often form repeated layers only centimeters thick showing how the environment was frequently changing from fast moving rivers to slower moving lagoon environments as the river deltas shifted.

Slide 12 - 13

All of the sedimentary rocks of the Peak District were deposited in water – either in large shallow tropical seas (limestones) or huge river delta systems (sandstones). Over millions of years, the shifting of the tectonic plates coupled with changes in sea level have effectively pushed the rocks up above the current sea level. As this was happening, the rocks were also gently folded into a dome. Once the rocks were exposed weathering and erosion by rivers, rain, and ice began to wear the rocks away. Some of the river valleys seen today were carved out during the last ice age around 12,000 – 10,000 years ago.
This has exposed the central core of the dome (known as an anticline) where the older rocks are.

Question – rocks are eroded by rain, wind, ice, plant growth and animal activity, and now human activity.
Question - The first rocks to wear away will be the higher ones (i.e at the top of the dome) and then the softer rocks like the shales, and the limestones which (very) slowly dissolve in water.

The image on slide 13 is Lathkill Dale – this valley, locally known as a 'dale' is formed of some of the oldest limestones, and is a fossilised coral reef. The dale was first cut by a river carrying melt water from glaciers during the Ice Age. At this time, large caves were also created in the area.

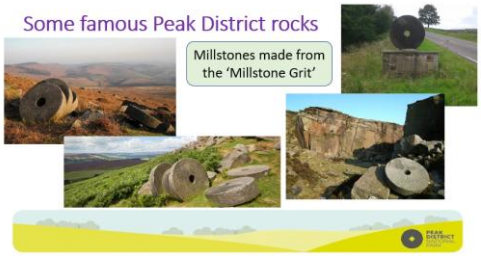


Slide 14 – 18

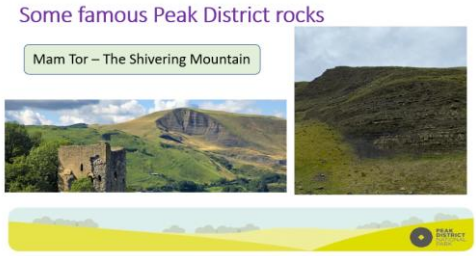
Millstones made of the gritstones were used to grind grains. They have a long history spanning many thousands of years. Their current basic form can be dated to before the Norman Conquest (1066) as corn mills are recorded in Domesday Book of 1086. Much more detail can be found here -
The Peak District Millstone: Peak District National Park

The millstone features in the logo of the Peak District National Park and is used as boundary markers along the major transport routes leading into the National Park.

You could ask your pupils if they have seen one of these boundary markers themselves. You can use this map to see where the boundary stones are: Map of Boundary Stones, and then use Google Streetview to explore and find some more.

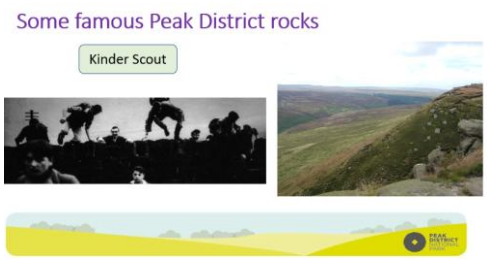


Slide 14 – 18

These gritstone edges are famous for their spectacular views and rock formations. They are very popular with walkers and are world famous rock climbing areas.	
Mam Tor (old English for 'mother hill'). It is a 517 m hill on the southern edge of the Dark Peak to the west of Castleton. It is locally called 'The Shivering Mountain' because of the frequent landslips which occur. These are a result of layers of weaker muds and shales underlying stronger sandstones. Water provides lubrication between the shales and the sandstones causing the shales to fail and slide. A main road (the A625) used to run along the base of the hill, but in 1979 the A625 was finally closed completely due to the regular landslips and the resulting costs of keeping the road open. The road still exists and can you can walk along it to see the 'broken road' for yourself, but it is closed to motor vehicles.	
'Blue John' is an informal name for a very rare semi-precious mineral called fluospar. It is only known to occur in the caves and hillsides around the village of Castleton. It is formed of calcium fluoride which was deposited in the limestones. It was discovered first by the Romans with larger scale tunneling beginning in the 1750s. The 'Blue John' makes a highly decorative stone and can be cut and polished. It is often made into jewelry and ornamental pieces. It is possible to visit the caverns. The book cover image is for a picture book called Blue John by Berlie Doherty – it's an excellent book often used for LKS2 but could also be used as inspiration for UKS2 writing. Find some great background notes here at Treak Cliff Caverns Stunning Showcave and Working Blue John Mine | Treak Cliff Cavern and notes_for_teachers.pdf	

Slide 14 – 18

Kinder Scout in the Dark Peak, close on the western edge of the Peak District, is the highest point in the Peak District at 636m above sea level. The top however is not a sharp peak but a moorland plateau.
It is famous as being the site of a 'mass trespass' in 1932 when several hundred walkers walked up on the then privately owned and fenced off moorland to protest about the need for open access land. The mass trespass is credited as being a catalyst for the formation of the National Parks and Access to the Countryside Act in 1949 and then the creation of the first UK National Park – Peak District National Park – in 1951.
More details here [The Mass Trespass: Peak District National Park]



Slide 19

Discuss that it has taken millions of years for the rocks to form but that they are likely to change in the future.
Weathering and erosion are physical and chemical processes which will wear away the rocks over time – main factors are rain, rivers, ice (freeze/thaw), and human wear and tear from walking/climbing. It is important to stress that these processes are very slow and will not involve the rocks being lost in a human life time.
The photograph on the right is Dovedale with the river in the valley.

Quarrying – this is also a risk to our geology and landscape but it can also be a fantastic opportunity to expose new sections of rocks and fossils and to retain some of these exposures once the quarry is restored.

By law, the National Park is required to "conserve and enhance the natural beauty, wildlife and culture heritage" of the Park and this includes its rocks and dramatic landscapes.

It's important to point out that rocks and fossils should not be collected especially if they are in situ (still in a rock outcrop) or in walls, buildings or other built structures. Leaving them for other people to see is a really valuable aspect of conservation.

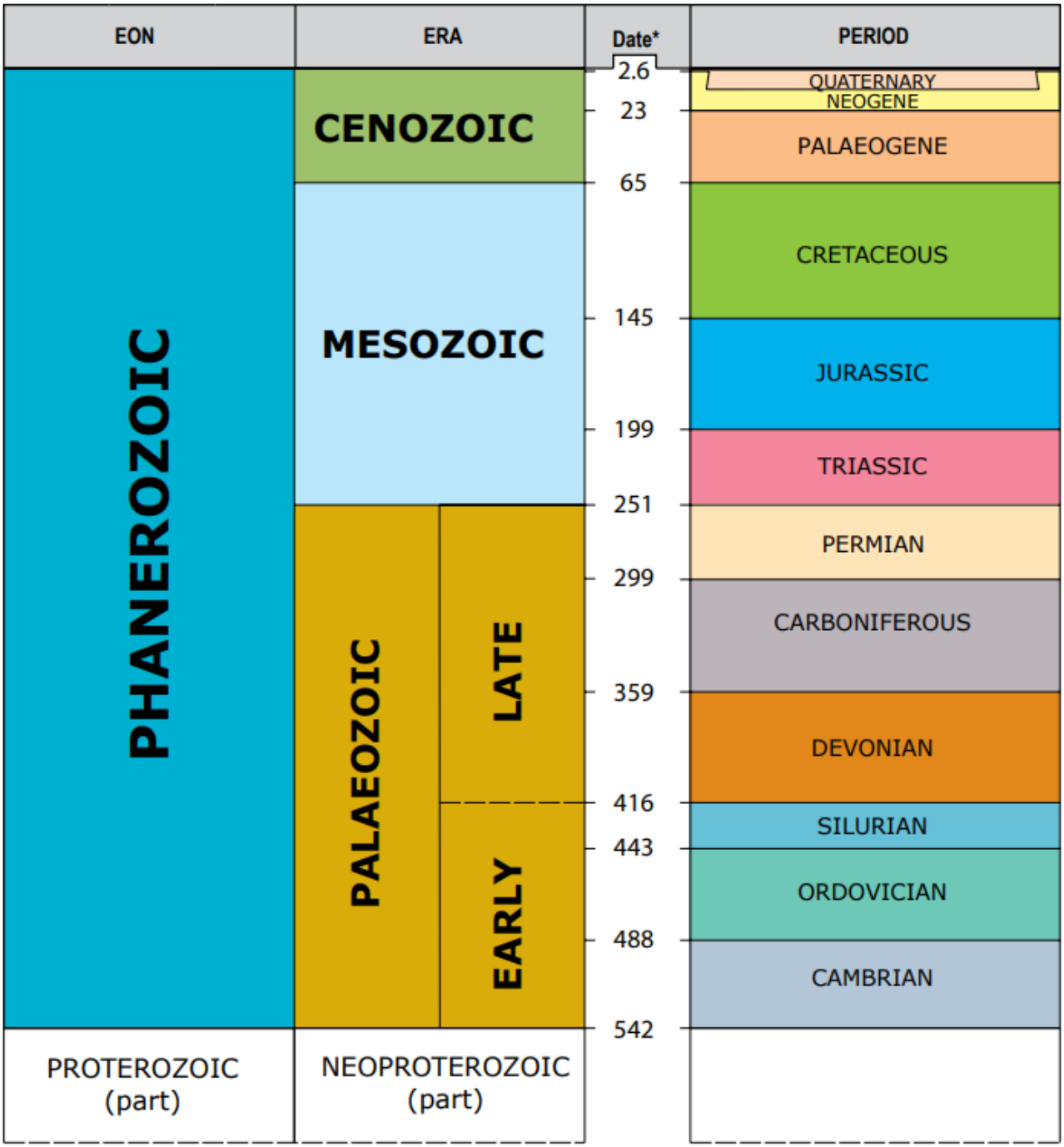
Slide 20

An opportunity for a discussion about rocks and the landscape features of the National Park.	

Peak District Ambassador Schools

PEAK DISTRICT NATIONAL PARK

Geological time line from British Geological Survey
(dates in millions of years ago)



Suggestions for follow-up activities

1. Have a look at a map of the Peak District National Park (you could use Google Maps, paper OS maps. Digimap for Schools or other software) and locate some of the places are that are mentioned in the PowerPoint such as Stanage Edge, Mam Tor, Lathkill Dale, Winnat's Pass, Kinder Scout etc.

2. Look at a geological map of the Peak District National Park – you can find an online one here BGS Geology Viewer - to see where the limestone, sandstone and shale outcrops. Pupils could find their own school and see which rocks are in their local area or see what other types of rocks are found in different locations in the UK.

3. Go for a walk to look at any rock outcrops which can be seen in own school grounds / local area: can you identify what type of rocks they are? (e.g. sandstone, shale, limestone)

4. Go for a walk to look any rocks which are used in local buildings: do they look like sedimentary rocks, igneous rocks, or metamorphic rocks?

5. Have a go at making some edible rocks – they are really useful for showing different textures of rocks and how they are layered. There are some ideas here STEM edible rocks and here Science Sparks.