MOURNE
GULLION
STRANGFORD
Aspiring UNESCO Global Geopark

ROCKS AND LANDSCAPES OF THE MOURNE GULLION STRANGFORD GEOPARK

ACTIVITIES FOR PRIMARY SCHOOLS

mournegullionstrangfordgeopark.com

Comhairle Ceantair
an Iúir, Mhúrn agus an Dúin
Newry, Mourne and Down
District Council

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INTRODUCTION

The Mourne Gullion Strangford Aspiring UNESCO Global Geopark takes in the scenic areas of the Mourne Mountains, the Ring of Gullion and Strangford and Lecale. The spectacular beauty of the Geopark has been forged by nature, torn apart by volcanic activity and sculpted by ice, providing a stunning backdrop to remarkable people and places.

UNESCO Global Geoparks are areas with internationally important rocks and landscapes, all of which are managed responsibly for tourism, conservation and education. Whilst geology may be their foundation, UNESCO Global Geoparks build upon that by bringing it together with other aspects of heritage such as archaeology, history, culture and biodiversity, which are intricately linked. All of this is in collaboration with local communities who help drive forward sustainable economic development and conservation to make it a better place to work, live and visit.

The Mourne Gullion Strangford Aspiring UNESCO Global Geopark has over 400 million years of geological history. It charts the closure of the Iapetus Ocean and the bringing together of the two parts of what we now know as the island of Ireland, its passage through tropical latitudes, the birth of the North Atlantic Ocean, and finally the shaping of landscape by ice during the last glaciation. All of this remarkable diversity within a relatively small area makes it an ideal outdoor classroom for all ages.

HOW TO USE THIS RESOURCE

The pack contains a series of six activities, all of which have been designed to demonstrate how the rocks and landscapes in this region formed. It will allow teachers to explore some of the amazing rocks and landscapes from the comfort of their own classroom as well as providing suggestions of where to see some of the best examples in the Mourne Gullion Strangford aUGGp.

This pack is aimed at NI Key Stage 2 pupils and fits in with the World Around Us element of the CCEA Primary Curriculum. However, it can also be used for Key Stage 3 Geography and adapted for Key Stage 1. The pack is also relevant for the Social Environmental and Scientific Education (SESE) element of the RoI primary curriculum at 3rd to 6th class level.

Whilst all of the activities can be used on their own, for a much broader introduction to Earth Science in the Primary Curriculum a complete resource has been prepared by Earth Science Ireland, in conjunction with the Geological Survey of Northern Ireland. These have been endorsed by the Council for Curriculum Examination and Assessment (CCEA) and can be found at ccea.org.uk/learning-resources/earth-science-lessons

All of the activities have been designed to be delivered as a demonstration to a class. Some activities will be suitable for small groups of pupils to carry out with supervision. However, this will depend on a number of factors including but not limited to age, ability and maturity so suitability is at the teachers' discretion. An appropriate risk assessment should always be carried out before any activity.

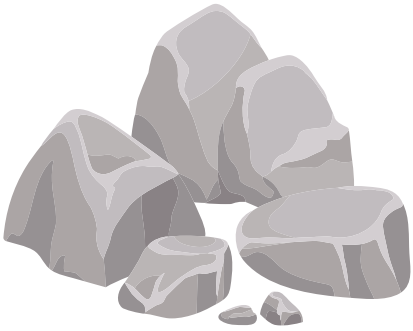
For more information on the Mourne Gullion Strangford aUGGp please visit **mournegullionstrangfordgeopark.com**

ACTIVITIES:

1: The Chocolate Rock Cycle
2: Exploding Volcanoes
3: Go with the (ice) flow
4: Mountain Building
5: Make your own shelly 'limestone'
6: Baked Rocks

INTRODUCTION TO GEOLOGY

Geology is the study of the Earth, what it is made of and the processes that formed these materials and are acting upon them still. Geologists are like detectives, in that they study the rocks from the past and piece together bits of information to establish how they were formed.



There are three main rock groups that geologists work with, all of which are found in Mourne Gullion Strangford Aspiring UNESCO Global Geopark:

1. SEDIMENTARY ROCKS

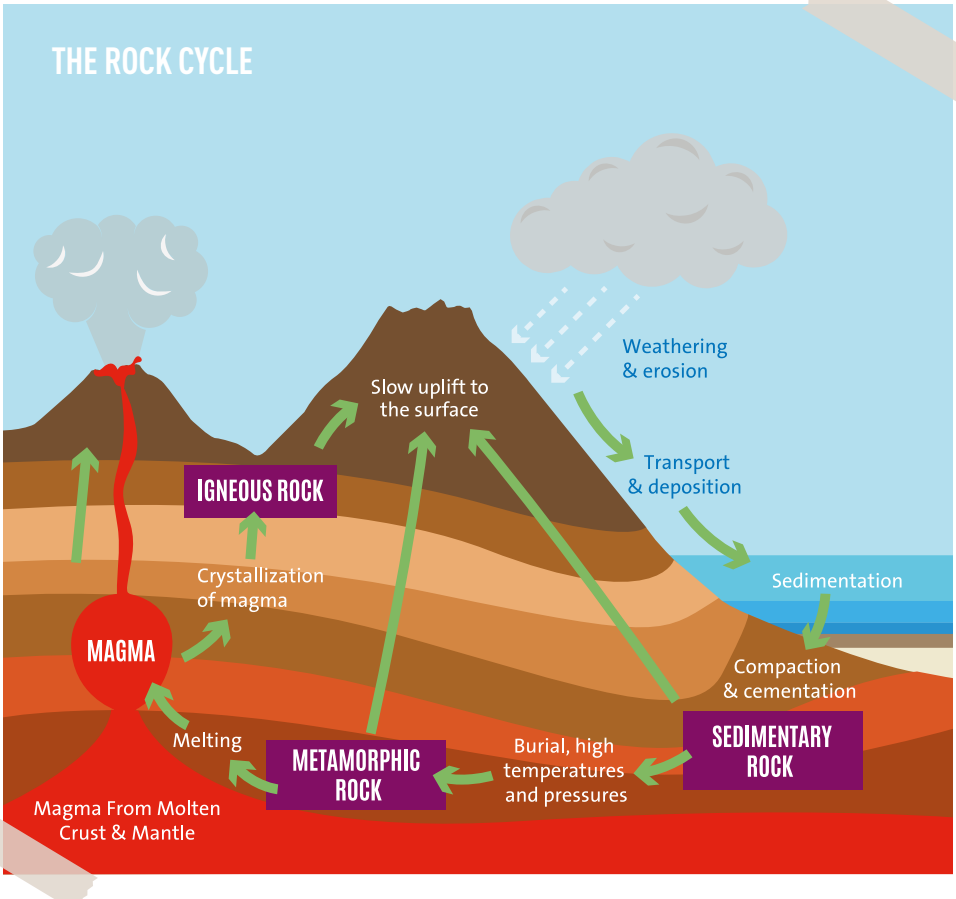
These rocks are generally made up of sediments such as sand, silt or mud that have been compacted and compressed to form solid rocks such as sandstone, siltstone and mudstone. They may also form by chemical or organic processes and result in rocks such as limestone or coal.

2. IGNEOUS ROCKS

This is the name for rocks that form from magma, or molten rock. They may form below the surface and form intrusive igneous rocks such as granite, or may form above the surface (as is the case with volcanoes) as extrusive igneous rocks such as basalt.

3. METAMORPHIC ROCKS

These rocks are those that have changed form due to excessive heat and / or pressure. An example of this is marble, it is a limestone that has been heated and subjected to intense pressure. It is important to note that although metamorphic rocks form by heat and / or pressure they were never molten.



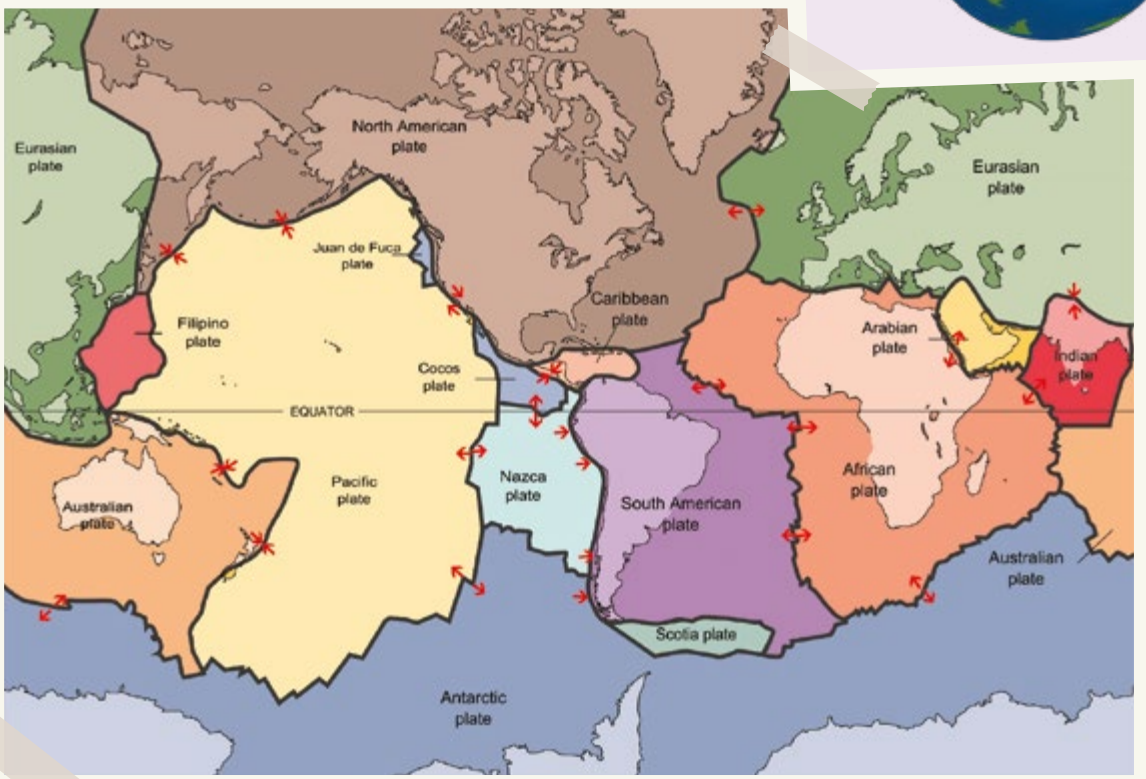
These rocks all form part of the rock cycle whereby all of the rocks are recycled over and over again. For example, metamorphic rocks are weathered and eroded to form sediments that eventually turns into a sedimentary rock. This is buried over millions of years so that it is melted and eventually forms an igneous rock. The igneous rock may then be heated and pressurised to form a metamorphic rock.

INTRODUCTION TO GEOLOGY

The rock cycle is dependent on the movement of the Earth's tectonic plates, the broken sections of the Earth's brittle outermost layer, the crust. The tectonic plates 'float' on top of the uppermost part of the layer below, the mantle. As the tectonic plates move, they collide, pull apart or move against each other causing not only earthquakes and volcanoes, but also the destruction and creation of tectonic plates.

EARTH'S TECTONIC PLATES

PLATE TECTONIC MAP



By having a basic knowledge of geology, we can get a better understanding of the history of our planet and use this to make decisions that will influence the future. This may include predicting when and where geological hazards such as volcanoes and earthquakes will occur; it may be used to locate important natural resources such as groundwater, metals and construction materials; or it may be used to better understand important issues such as climate change. Only by studying the natural rocks and landscapes can we understand how to best sustainably develop our planet for the benefit of future generations.

GEOLOGICAL HISTORY

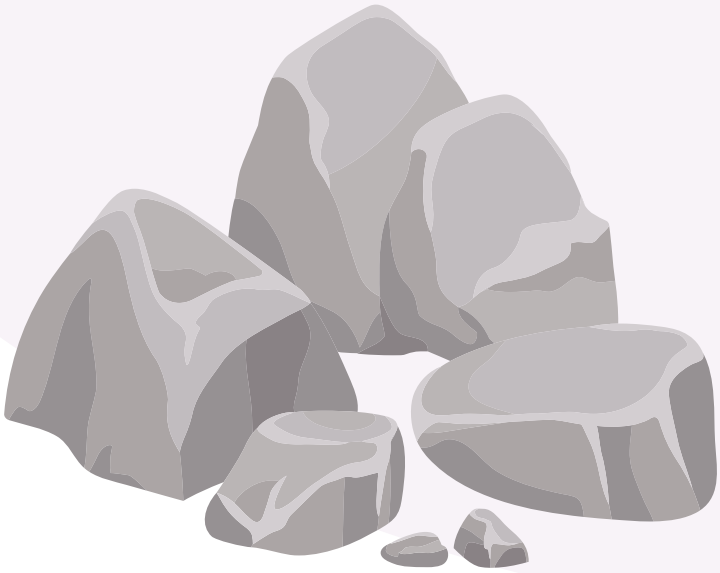
The rocks and landscapes of the Mourne Gullion Strangford Aspiring UNESCO Global Geopark tell us a story that begins over 400 million years ago and continues to the present. The landscape that we see today is only a small moment of geological time and the area has witnessed many changes in its long and interesting history.

AN ANCIENT OCEAN

The oldest rocks in the Geopark are around 440 million years old and formed at the bottom of a deep ocean called Iapetus. This ocean has long since disappeared but it would have been 1000s of kilometres wide separating the two halves of the island of Ireland on either side. These rocks would have been laid down as sand silt and mud at the bottom of the ancient ocean but are now seen as layers of sandstone, siltstone and mudstone.

MOUNTAIN BUILDING

Plate tectonic movement caused the Iapetus Ocean to close, bringing the two halves of the island of Ireland closer together and eventually colliding. This huge Earth movement caused the horizontal layers of sandstone, mudstone and siltstone to deform and as a result, they are often seen as folded layers, and often nearly vertical. The large amounts of heat generated because of this activity caused molten rock to gather beneath the surface in magma chambers where it cooled and crystallised to form solid rock. This is now seen as the Newry 'granite' that extends from Forkill to Slieve Croob.



TROPICAL SEAS

Approximately 350 million years ago, the region lay very close to the equator and was covered by a shallow tropical sea. Many animals lived in the sea such as corals, brachiopods (sea shells) and crinoids (sea lilies), the remains of which, together with the lime-rich mud of the sea floor, are now found as limestone.

A NEW OCEAN

As plate tectonic activity continued, around 60 million years ago, the North Atlantic Ocean started to open, as the continents that we now know as North America and Eurasia began to rip apart. This led to major volcanic activity and vast amounts of molten rock once again gathered beneath the surface. There is little remaining evidence of volcanic eruptions from that time, and a number of massive magma chambers formed before cooling and crystallising as solid rock. This is now seen as the Ring of Gullion, Slieve Gullion and the Mourne Mountains.

ICY WASTELANDS

During the last 2 million years the Earth has become much cooler and on several occasions the ice at the poles has grown to cover huge areas of the planet, known as an Ice Age. Within each Ice Age, the ice grows and shrinks again with each period of growth known as a glaciation. The last glaciation ended in Ireland 15,000 years ago and in the Geopark, the ice was over one kilometer thick. The movement and melting of the ice sheets has sculpted the majority of the natural landscape into the shapes that we see today.

ACTIVITY 1:
THE CHOCOLATE ROCK CYCLE

AIM

To demonstrate the concept of the rock cycle using chocolate

WHAT YOU'LL NEED

- Blocks of dark and white chocolate
- Source of hot water
- Aluminium foil and/or aluminium foil cake cups
- Container to hold hot water
- Simple scraping device e.g. plastic knife

NB This activity uses hot water so please take extra care

INSTRUCTIONS

TO MAKE SEDIMENTARY CHOCOLATE

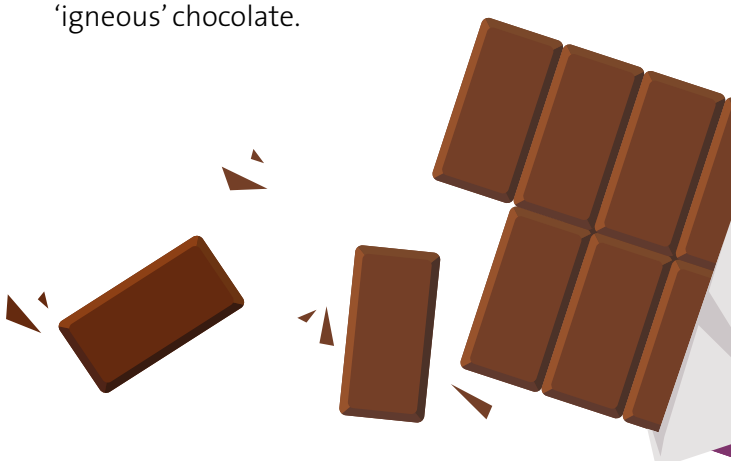
1. Scrape some small sized shavings from the chocolate blocks.
2. Gather these scrapings onto a piece of aluminium foil.
3. Cover with another piece of aluminium foil and then press on the chocolate shavings (children may want to stand on the foil packages)
4. The coherent bunch of chocolate scrapings in the foil is now equivalent to 'sedimentary' chocolate.

TO MAKE METAMORPHIC CHOCOLATE

1. Place a small pile of the 'sedimentary' chocolate, together with some of your original shavings not used and one or two small chunks from the original block into aluminium foil or a cake case.
2. Float this on hot water.
3. Watch as the heat from the water transfers to the foil and to the chocolate which should start to melt.
4. Remove the foil when the chocolate is soft to the touch (use the plastic knife or similar to test this not fingers)
5. Let the chocolate cool.
6. The partially melted and cooled chocolate is now the equivalent of 'metamorphic' chocolate.

TO MAKE IGNEOUS CHOCOLATE

1. Place a small pile of sedimentary and metamorphic chocolate and some chunks from original block into aluminium foil or cake cup.
2. Float this on very hot water.
3. Watch as the heat transfers from the water to the foil and then the chocolate and it starts to melt.
4. The chocolate should be allowed to melt until a smooth liquid forms.
5. Carefully remove the molten chocolate and let it cool. The totally melted and cooled chocolate is now equivalent to 'igneous' chocolate.



WHAT'S HAPPENING?

Pupils should understand that all rocks are part of the rock cycle. Sedimentary rocks form as a result of sediments that have been compressed and/or compacted, igneous rocks form as a result of melting sedimentary and/or metamorphic rocks and metamorphic rocks form as a result of heat and/or pressure being applied to either an igneous or sedimentary rock but they do not fully melt. All of the rocks on Earth are recycled from earlier ones.

MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

The geology of the Geopark contains examples of all three of the main rock groups. Sedimentary rocks are found around the coastline of the entire area with good examples of sandstone, mudstone and siltstone seen at **Annalong** and **Ardglass** (see An Ancient Ocean and Mountain Building in the Geological History section). Igneous rocks make up the majority of the area's uplands with the **Mourne Mountains** formed from granite, and **Slieve Gullion** formed from basalt and granite (see A New Ocean in the Geological History section). Metamorphic rocks are found at **Slieve Croob** where the original mudstones have been heated and altered by the adjacent igneous intrusion (see Mountain Building in the Geological History section).

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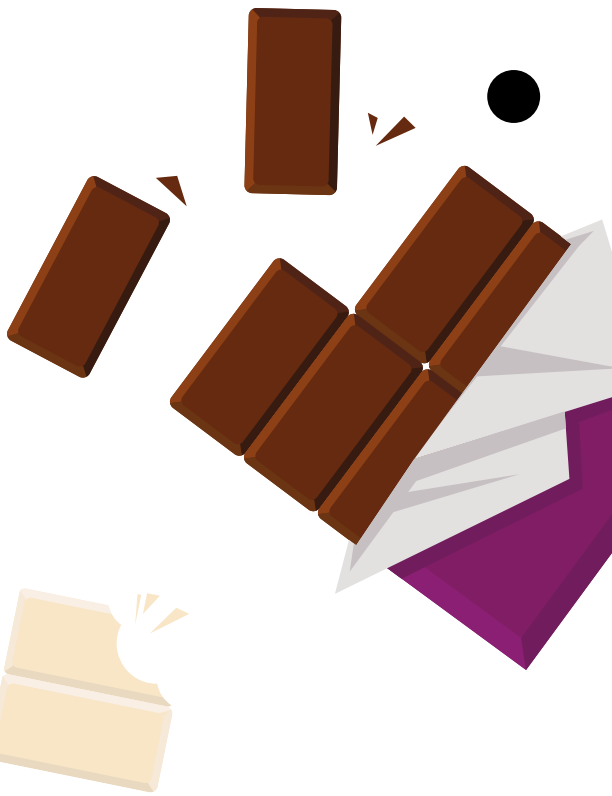


ACTIVITY 2:
EXPLODING VOLCANOES

AIM

To understand how volcanoes explode

WHAT YOU'LL NEED

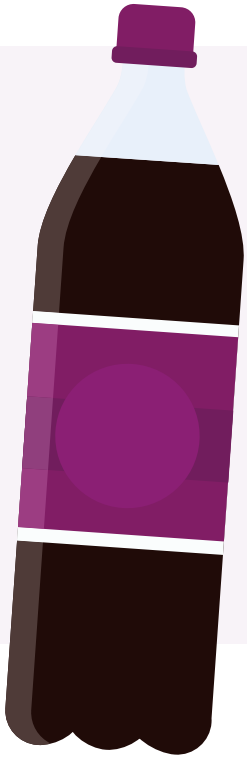
- Small bottles of Diet Coke (or a cheaper alternative)
- Several packets of Mentos
- A couple of trays
- A bucket for emptying into afterwards

INSTRUCTIONS

1. Set a bottle of Diet Coke on each tray. Explain that this will be the magma chamber of the volcano, and like many volcanoes in the world, it is currently not erupting.
2. Now you need to make the volcano erupt. First of all take the lid off each of the bottles and explain that you are going to make the volcano erupt by increasing the pressure within the magma chamber.
3. Give one child next to each of the trays a couple of Mentos and then do a count down backwards from five and then quickly add in the Mentos.
4. Stand back and watch as the Diet Coke 'erupts' from the bottle. Explain that this is happening as the pressure is increased within the bottle causing the Diet Coke to expand and erupt from the bottle. This is similar to what happens in a real volcano.
5. Repeat this as necessary.

WHAT'S HAPPENING?

The most common volcano experiment is done using bicarbonate of soda and vinegar, but this is merely a chemical reaction. This experiment accurately conveys the build up of pressure (bubbles inside the Diet Coke bottle) inside a volcano, and once this pressure is suddenly released (by adding a Mento) it causes the volcano to erupt. This is a physical reaction as opposed to a chemical one.



MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

The majority of the upland areas in the Geopark formed as a result of volcanic activity, however for the most part there is little evidence of actual volcanic eruptions. There are however some good examples in the area around the Ring of Gullion from around 60 million years ago (see A New Ocean in the Geological History section) including in **Glendesha Forest** where you can see felsite (a fine-grained volcanic rock) and other volcanic products.

NOTES

ACTIVITY 3:
GO WITH THE (ICE) FLOW

AIM

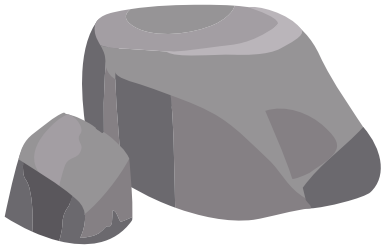
To understand how ice flow direction is determined

WHAT YOU'LL NEED

- Five pairs of rocks of different types, one larger sample and one smaller
- Towel, jackets or something to cover the big rocks
- Masking tape, string or something visual to show a straight line

INSTRUCTIONS

1. Put the bigger rock samples around the classroom and cover them up.
2. Pick five pupils to be a 'glacier'.
3. Have all other pupils leave the room or put their heads down so they can't see.
4. Give each of the five pupils a small hand sample and have them stand at the big rock of the same type. Tell them that when you give them the signal, they need to walk in a straight line, any direction or distance they want, and set the small sample down on the floor, then quietly walk to the front of the room.
5. Place the rest of the pupils into groups of 2 or 3, depending on the size of the class. Tell them that there are small rocks and big rocks hidden around the classroom. In their groups, they have to find one of the small rocks, but they are not allowed to touch it or move it. They need to study the rock and then look for the big rock that matches. The big rocks are under the jackets (kind of like how outside, the rocks are hidden under trees and soil) and they can lift the jacket, see if it looks like their rock or not, and keep going until they find their match. Their match is the 'source' rock, where the glacier picked up the rock.
6. Once they have found the source rock and the erratic (hand sample), have them make a straight line between the two with masking tape or a piece of string.



WHAT'S HAPPENING?

The Earth has experienced a number of Ice Ages when temperatures were much lower than today and ice sheets extended to cover vast areas. By looking at glacial erratics (huge boulders on the landscape that have different geology to the bedrock below) geologists can work out where the ice has come from and how far it has travelled. This is because the huge boulders would have been picked up by ice sheets and carried with them as they moved, only dropping them when they started to melt.

MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

The Geopark landscape was shaped and sculpted by glaciers during the last Ice Age. The entire area was littered with glacial erratics at one point, many of these have since been cleared to make way for farmland. There are some that are still easily seen with the most famous being **Cloughmore**. This huge boulder sits on the slopes of Slieve Martin on the western edge of the Mournes and is made of granite. However, this granite is not the same as the Mourne granite and is more similar to that found on the west coast of Scotland helping geologists to work out that ice must have travelled down the Irish Sea from there during the last Ice Age (see Icy Wastelands in the Geological History section).

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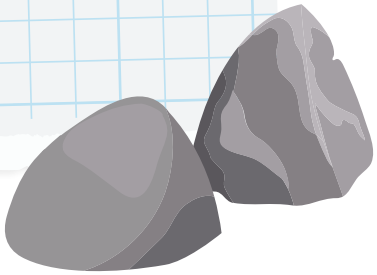

ACTIVITY 4:
MOUNTAIN BUILDING

AIM

To demonstrate how mountains are formed

WHAT YOU'LL NEED

- A Ferrero Rocher box (eat all of the chocolates first!)
- A cup of clean dry sand
- A cup of flour
- A piece of stiff cardboard or wood to fit in the end of the box

INSTRUCTIONS

1. Place the cardboard inside one end of the box. You need to make sure that this stays upright while you are filling the box.
2. Put a layer of sand in the base of the box, ensuring that it is completely covered. Smooth the top surface of the sand before adding in a layer of flour, once again ensuring that the layer of sand below is completely covered. Keep repeating this until the box is nearly full.
3. Once you have layered your box, carefully move the cardboard / wood as if you are trying to move it to the other side, squashing the contents in between as you go.
4. If you do this in stages and look at the side of the box each time you move the cardboard / wood, you will notice that the layers of sand and flour are folding. They are also pushing the sand and flour upwards, creating 'mountains'.

WHAT'S HAPPENING?

Mountain ranges form as tectonic plates collide, causing the crust to crumple and fold, pushing the rocks upwards. This the same process that is forming the Himalayas, the highest mountains on Earth.

MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

Although there are no Himalayan-scale mountains in the Geopark, the closure of the Iapetus Ocean resulted in continental collision and the formation of a vast mountain range further to the north of the area. The effects of this tectonic activity caused the deformation of the sedimentary rocks seen all along the coast with good examples at **Strangford** and **Ballyhornan** (see Mountain Building in the Geological History section). These once horizontal layers of rocks are now nearly vertical and often display folding and faulting.

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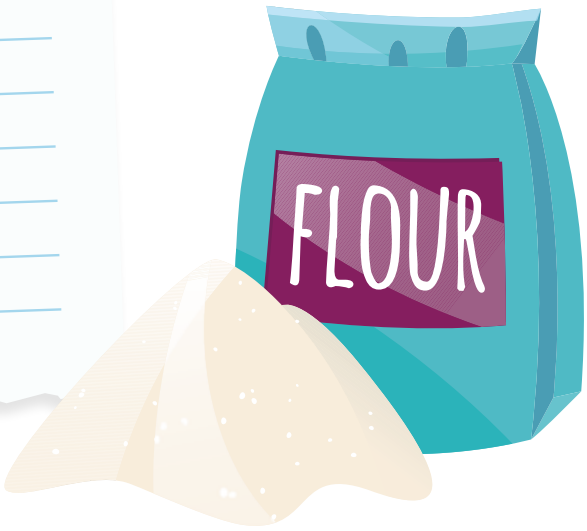
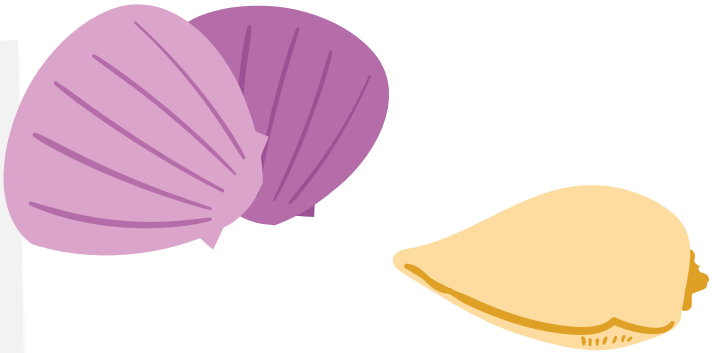


ACTIVITY 5:
MAKE YOUR OWN SHELLY 'LIMESTONE'



AIM

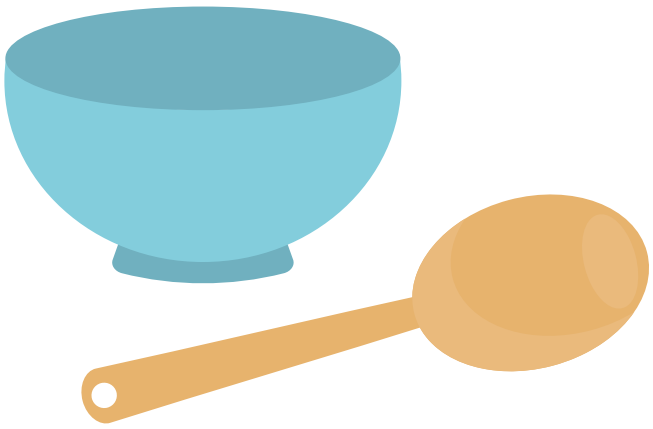
To learn about the components of limestone

WHAT YOU'LL NEED

- Some Play Doh (or other modelling material)
- Two cups of plaster-of- Paris
- Cup of water
- ½ cup of cold black coffee
- ½ cup of sand
- Handful of shells, larger ones broken up
- Some tin foil
- A large mixing bowl
- A wooden spoon
- A hammer and a chisel

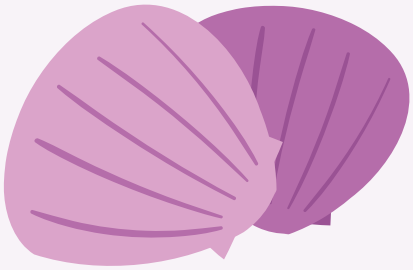
INSTRUCTIONS

1. Shape your play doh into a mould that you can pour your limestone mix into. This should be roughly the size of an adult fist. Cover the surface you are going to put it into with foil.
2. In your mixing bowl, combine the water and plaster-of-Paris until smooth, then add in the sand and enough cold coffee to give a good colour. Once this is mixed together, add in the shells.
3. Pour the mixture into the mould and allow it to set for at least 3 hours, ideally overnight.
4. Remove from the mould and you will have your fake shelly limestone. To see inside, use a hammer and chisel to open the limestone and expose the shells within (This should be carried out by teachers only).



WHAT'S HAPPENING?

Limestone usually forms in a marine environment, commonly on the bottom of a sea floor. It forms as layers of lime-rich mud together with the remains of dead sea creatures build up on the sea floor and eventually, over millions of years, harden to form solid rock.



MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

Limestone is found in one area of the Geopark with exposures near **Cranfield Beach**. These rocks formed during the Carboniferous period (see Tropical Seas in the Geological History section) at the bottom of a shallow tropical sea, and contain many marine fossils. The sea floor would have had a significant mud content so the limestone is dark grey in colour.

NOTES

ACTIVITY 6:
BAKED ROCKS

AIM

To understand how contact metamorphism occurs

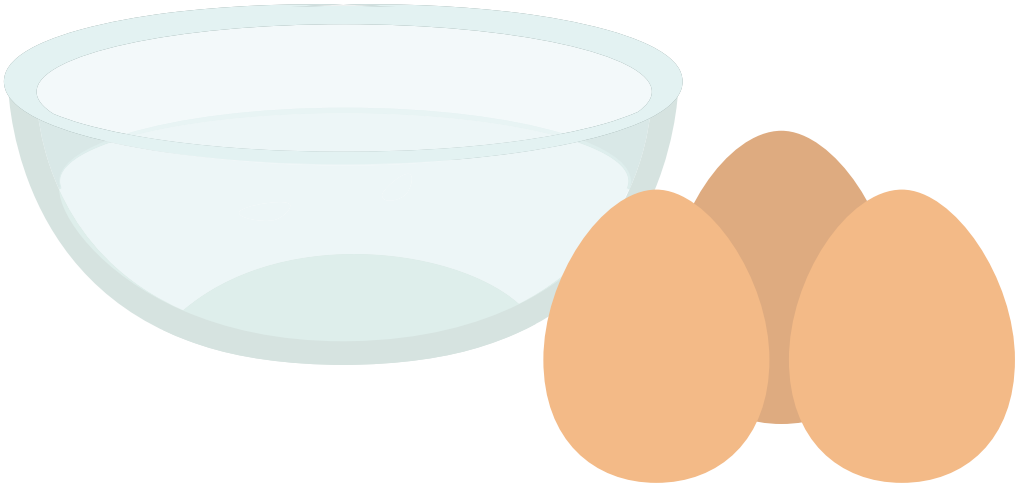
WHAT YOU'LL NEED

- A shallow square or round cake tin
- Six egg whites
- A Pyrex beaker (or the insert from a cafetiere will do)
- Freshly boiled water

NB This activity uses boiling water and raw eggs so please take extra care

INSTRUCTIONS

1. Put your egg whites into the cake tin
2. Place your Pyrex beaker into the middle of the egg whites. Pour in the freshly boiled water and leave for 10 minutes.
3. After 10 minutes you'll see that the egg white around and beneath the glass has turned white as it has cooked.



WHAT'S HAPPENING?

When magma is intruded into the pre-existing surrounding rock (known as the country rock), the resulting heat can sometimes 'bake' the country rock. Rocks like granite can reach temperatures of up to 1200°C when they are molten and this heat causes the country rock at the edge of the magma chamber to change form. This is a process known as contact metamorphism. Quite often this zone of baked rock forms all around the edges of ancient magma chambers and it disappears the further away you get from the contact between the igneous rock and the country rock.

MOURNE GULLION STRANGFORD ASPIRING UNESCO GLOBAL GEOPARK

The granites that make up the Mourne Mountains were intruded into much older country rock around 60 million years ago. The heat generated caused a significant amount of contact metamorphism around the edge of the magma chamber and this is known as a metamorphic aureole. The best place to see this is at **Bloody Bridge** where the country rock has changed to a rock called hornfels due to contact metamorphism.

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