Year 3 science: Rocks and soils

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Aim

- I can compare different types of rocks.

Success Criteria

- I can name the three different types of rocks.
- I can explain the difference between natural and human-made rocks.
- I can use the appearance of rocks to group and compare them.

Rocks

What are rocks?

What do you already know about rocks?

Are rocks alive? How do you know?

Why are there rocks everywhere?

How do rocks form?

Look carefully at the photographs on following slides and spot the rocks.

Spot the Rocks

Countryside

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Spot the Rocks

Chalk Cliffs

Photo courtesy of tsbl2000 (@flickr.com) - granted under creative commons licence – attribution

Spot the Rocks

Muddy Fields

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Spot the Rocks
Town Centre

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Spot the Rocks

Granite Peak

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Spot the Rocks

Volcano

Photo courtesy of coolinsights (@flickr.com) - granted under creative commons licence – attribution

Spot the Rocks

Mountain

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Spot the Rocks

Pebble Beach

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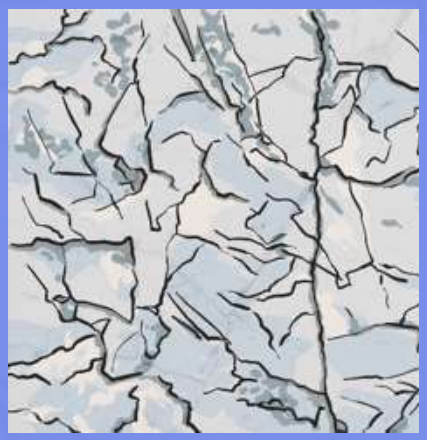
Natural Rocks

There are **three types** of naturally occurring rocks.

Igneous

Sedimentary

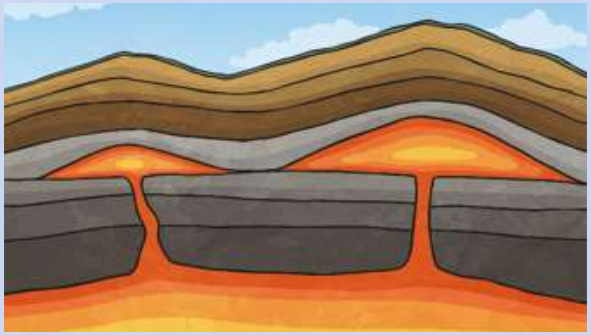


Metamorphic

Natural Rocks
Igneous Rock

Far under the ground, the temperature is hot enough to melt the rock into a liquid. This is called molten rock. Igneous rocks are formed from this molten rock in two ways.

Intrusive Igneous Rocks:



Molten rock that remains underground is called magma. When magma cools and hardens it becomes a type of intrusive igneous rock.

(Intrusive = internal = inside)

Extrusive Igneous Rocks:

Molten rock that comes out of the ground is called lava. When lava cools and hardens it becomes a type of extrusive igneous rock.

(Extrusive = external = outside)

Natural Rocks

Sedimentary Rock

Sedimentary rock forms under the sea.
The following illustrates the process:

1) As a result of weathering and erosion, bits of rock end up in lakes and rivers. Rivers transport bits of rock and deposit them on the bottom of the sea.
This process is called **sedimentation**.

2) With time, more layers (strata) pile up and press down on the lower layers of rock. This process is called **compaction**.

3) Over time, water is pushed out from these layers and the process of **cementation** occurs. This is when salt compounds glue or cement the bits of rock together so they form a solid layer.

Natural Rocks

Metamorphic Rock

Metamorphic rocks don't just form from being near magma they can also be formed from Earth movements which can cause rocks to be deeply buried or squeezed. This means the rocks are heated and put under immense pressure which causes the minerals they contain to be changed chemically. Collision of tectonic plates can also result in the formation of metamorphic rock too.

This illustration shows how the igneous rock near magma is being heated and changed.

This illustration shows how the sedimentary rock near magma is being heated and changed.

Human-Made Rocks

The scientific name for human-made rocks is **anthropic** rocks. Anthropic rocks are made, modified or moved by humans.

Concrete

The Romans first invented **concrete**, although the type of concrete we use today dates from 1756.

Concrete is a mixture of water, aggregate (either sand, rock or gravel) and cement
(a mixture of chalk and clay).

Human-Made Rocks

Mock Rock

Victorians created rock gardens and surfaces that looked like rock from **mock rock.** Types of mock rock include **pulhamite,** which looked like gritty sandstone.
James Pulham, who invented it, took the exact recipe for it to the grave! **Coade stone** (made from grog, flint, quartz, soda lime glass and clay) is another type of mock rock.

Bricks

Bricks have been around for a long time. The first bricks come from a place called Tell Aswad in modern day Syria. That was in 7500 BC! However, bricks were used to build in most of the ancient civilisations and are still used today. Bricks are usually made of clay soil, sand and lime or concrete materials. They can be air dried or fire-hardened.

Natural or Human-Made?

You will be looking at a selection of rocks in groups: igneous, sedimentary or metamorphic or manmade.

Coade Stone

Sandstone

Quartzite

Basalt

Limestone

Slate

Brick

Granite

Chalk

Marble

Concrete

Obsidian

Natural or Human-Made

Natural Rocks

Igneous

Obsidian

Granite

Basalt

Sedimentary

Chalk

Sandstone

Limestone

Metamorphic

Marble

Quartzite

Slate

Human-Made Rocks

Brick

Concrete

Coade Stone

Fact or Fiction?

Igneous rock is formed by magma and lava.	Fact	Fiction
Metamorphic rock turns into liquid.	Fact	Fiction
Sedimentary rock forms on land.	Fact	Fiction
There are two types of igneous rock.	Fact	Fiction
Chalk is a type of human-made rock.	Fact	Fiction
Human-made rocks do contain natural rocks as well.	Fact	Fiction
The man who invented pulhamite took the recipe to the grave.	Fact	Fiction

Fact or Fiction?

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The man who invented pulhamite took the recipe to the grave.	**Fact**	**Fiction**

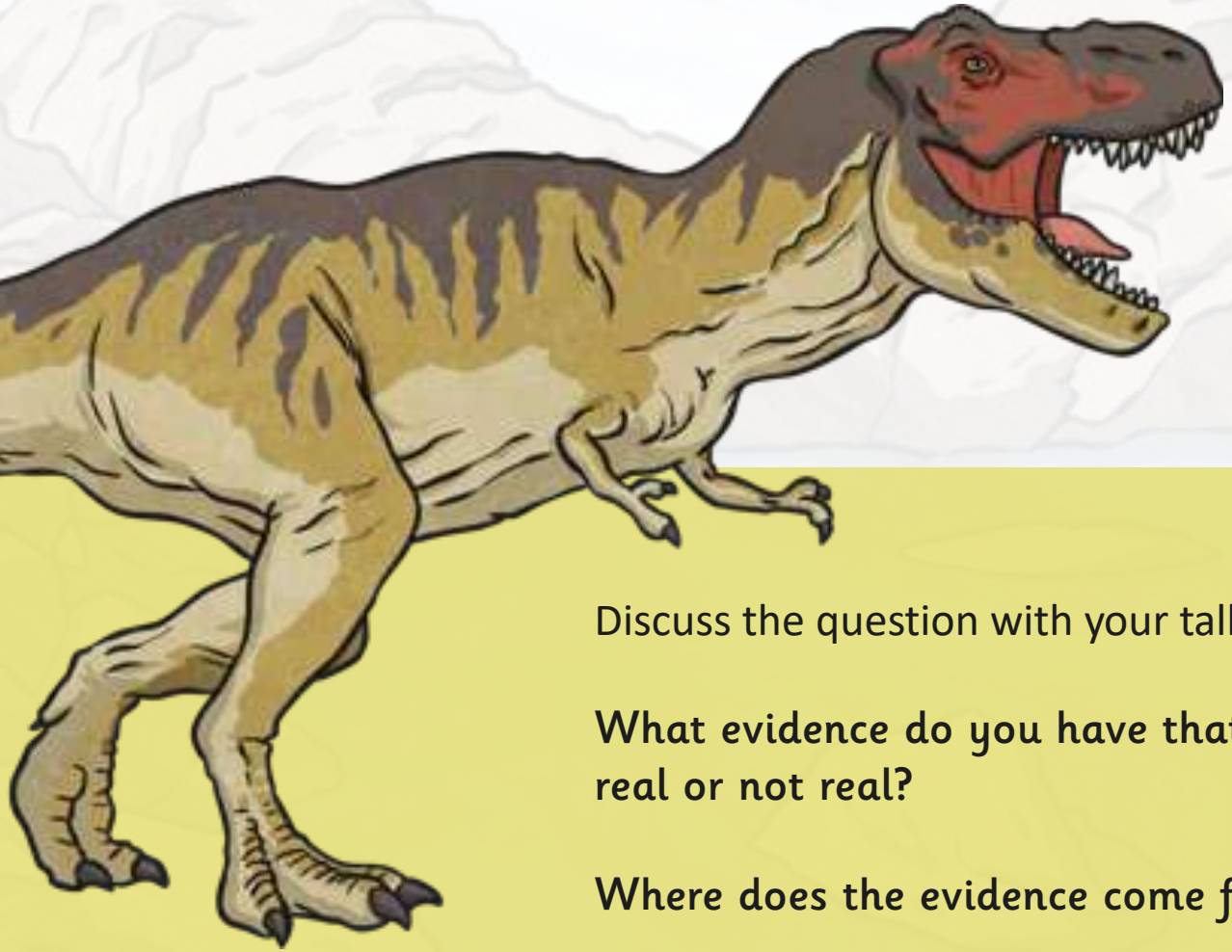
Aim

- I can explain how fossils are formed.

Success Criteria

- I can explain the difference between a bone and a fossil.
- I can order the steps of how a fossil is formed.

Are Dinosaurs Real?



Discuss the question with your talk partner.

What evidence do you have that they are real or not real?

Where does the evidence come from?

Are Dinosaurs Real?

It is believed that dinosaur fossils have been found for centuries and these gave rise to some of the mythical creatures in ancient cultures. However, without documented evidence we can not know this for sure.

What we do know is that our current knowledge of dinosaurs and palaeontology (the study of fossils) started in the 1800s. So we really have only known about them for the last 200 years! We know about dinosaurs due to the discovery of fossils and fossilised skeletons.

Bones or Fossils?

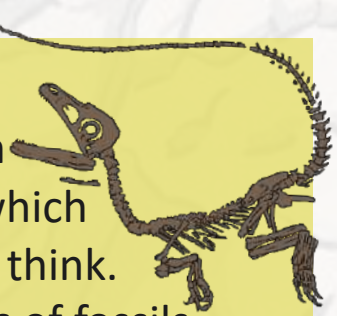
There are some key concepts we need to know before moving on.

What is the difference between bones and fossils?

Bones

Bones are any piece of the hard whitish tissue that makes up the skeleton in animals including humans.

Fossils



Fossils are more than just ancient bones, which is what many people think. There are three types of fossils – body fossils, trace fossils and chemical fossils.

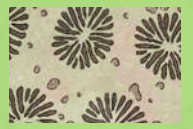
Chemical fossils

Chemical fossils contain carbon, which is proof that they must be formed from once living things. Examples of chemical fossils include coal, petroleum oil and natural gas.

Body Fossils

Body fossils are the remains of an animal or plant such as bones, shells or leaves. There are three types of body fossils:

Mould and Cast Fossils



Mould fossils form when all the parts (including the bones) have decayed and all that is left is the mould of the animal.

Cast fossils form from mould fossils as the mould fossil is filled up with sediment – so it is not made up of the original matter of the animal or plant.

Replacement Fossils

Replacement fossils form when water dissolves the original hard matter of the bones and replaces them with mineral matter – this is what we think of when we discuss dinosaur fossils. They still look like the original bones but are not made up of the same matter.

Whole Body Fossils

Whole body fossils form when the original body has been preserved – for example a woolly mammoth in ice or a mosquito in amber.

Trace Fossils

These are fossils that record the activity of an animal including:

Footprints

Trackways

Coprolites
(fossil faeces)

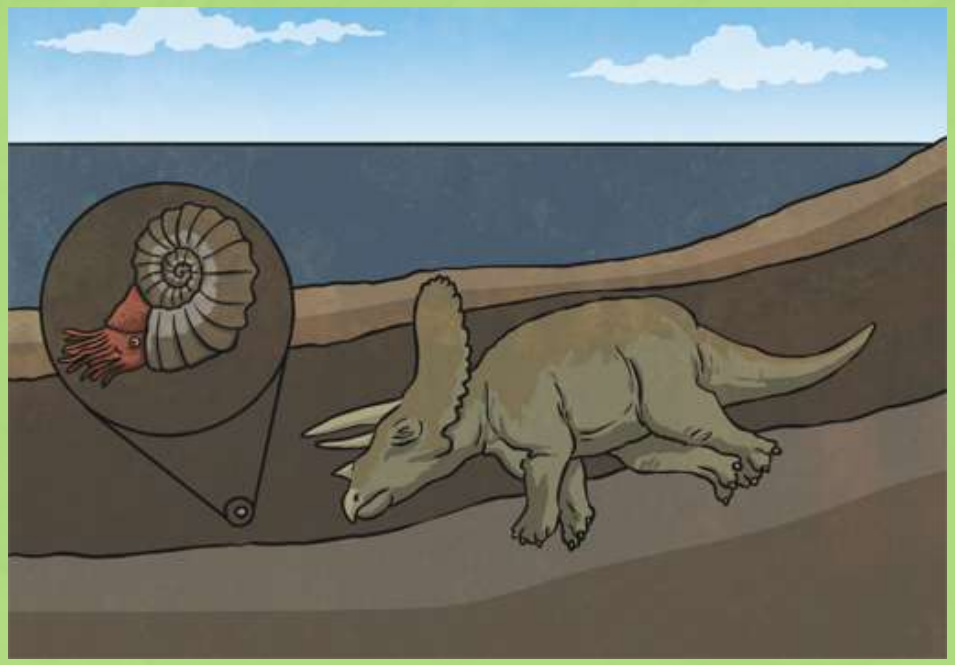
Fossilisation Process

There are many different ways that fossilisation occurs. However, you will focus on how fossils form in rocks (both body and trace fossils).

Fossilisation only takes place in sedimentary rocks as the heat from the lava that creates igneous rocks and changes the structure of metamorphic rocks would be too high for fossils to survive.

Fossilisation Process; Step 1

An animal or creature dies on land or in the sea and it gets covered by a layer of sediments (e.g. plant material and tiny parts of rock or soil etc). Over time, through compaction and cementation (solidifying), these eventually form a layer of rock.



Fossilisation Process; Step 2

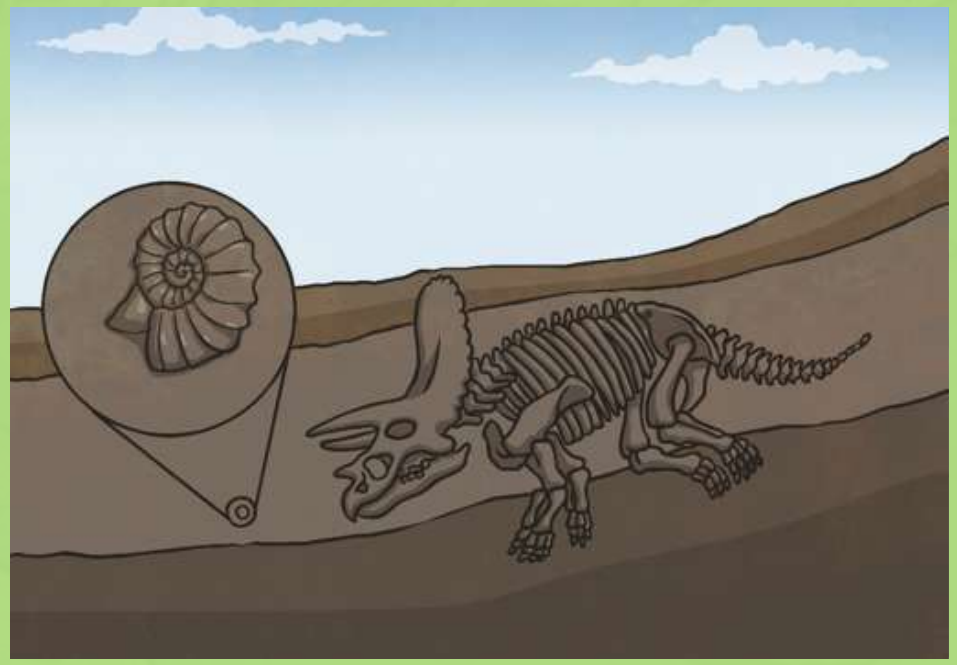
Over time more layers of rock are formed which cover it and by this time the only thing to remain of the organism would be the hard parts such as bones, shells and teeth.

Fossilisation Process; Step 3

Over thousands of years the mould fossil might become a cast fossil with sediment entering the mould. In the case of replacement fossils, the original bone matter changes to mineral matter but this does not affect the shape of the bones.

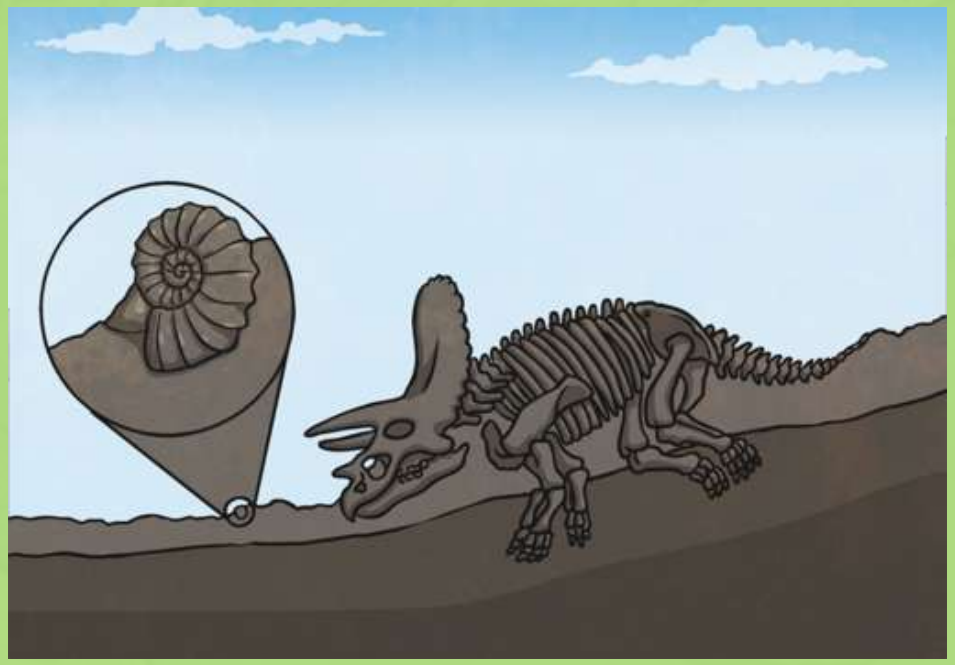
Fossilisation Process; Step 4

Over a long period of time the sea will recede in certain places. The sea level could also be changed quickly through earthquakes and volcanic eruptions.



Fossilisation Process; Step 5

As erosion and weathering takes place, eventually the fossils become exposed.



Order the Fossilisation Process

As erosion and weathering takes place, eventually the fossils become exposed.

Over a long period of time the sea will recede in various places.

Over time more layers of rock cover it and by this time the only thing to remain of the animal would be its bones (except in the case of mould fossils where the bones would also be decayed).

An animal or creature dies and ends up in the sea. It gets covered by a layer of rock.

Over thousands of years the mould fossil might become a cast fossil with sediment entering the mould. In the case of replacement fossils, the original bone matter changes to mineral matter but this does not affect the shape of the bones.

Aim

- I can explain Mary Anning's contribution to palaeontology.

Success Criteria

- I can explain what a palaeontologist does.
- I can understand why Mary Anning's fossil findings were important.
- I can describe how palaeontology has changed our understanding of prehistoric animals.

Palaeontology and Palaeontologists

Key words to learn!

Palaeontology

(pay-lee-on-tolo-jee)

Palaeontologist

(pay-lee-on-tolo-jist)

What could a palaeontologist be?

What would a palaeontologist do?

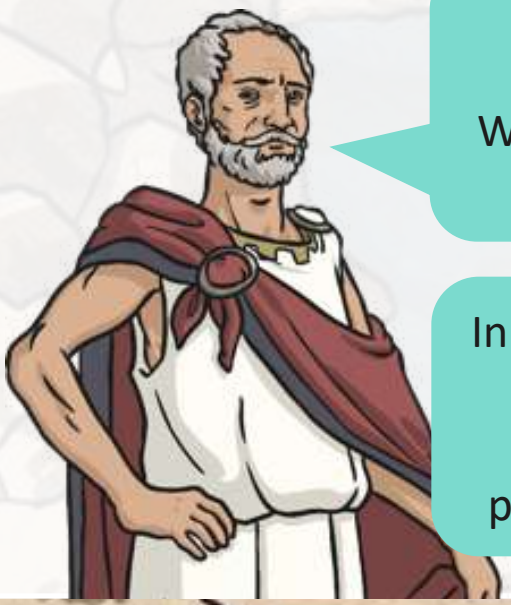
Use your previous learning in this unit to help you work it out.

History of Ideas About Fossils

Fossils have been found by people throughout history.

It's only in the last two hundred years that we have begun to understand what these fossils really are and how they formed.

Here are some ideas from the past.



We ancient Greeks found fossils of marine animals.
We realised that this meant some land used to be under water.

In ancient China, we found many fossils of dinosaurs although these were mistaken for dragon bones! Some people even used them in medicines!

Georges Cuvier
The Breakthrough

Believe it or not, in the past people were not convinced that some animals had become extinct (died out)!

Cuvier proved that fossils found were of animals, who were similar to animals that were known like elephants, but which had died out due to natural disasters like floods.

This was a really important idea which led to the beginning of Palaeontology (the study of fossils) as it proved the existence of animals that humans did not know about as they had died out before our time.

Georges Cuvier
The Breakthrough

Georges Cuvier named the fossil of a flying reptile Pterodactylus.

Cuvier's ideas were supported by evidence of fossils found in Britain, particularly those of Mary Anning.

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Types of Fossils

Whole Class

Before we find out more about Mary Anning, let's see what you remember about the different types of fossils. In groups discuss what is hidden under the shapes.

Types of Fossils

Body Fossils

Trace Fossils

Chemical Fossils

The remains of animals or plants

Show animal activity

Matter containing carbon

Footprints and Trackways

Mould Fossils

Cast Fossils

Replacement Fossils

Whole Body Fossils

Coprolites

Mary Anning

Whole Class

So who was Mary Anning and what did she find that was so important?

While watching the video see if you can work out the types of fossils she found.

What have you learnt about Mary Anning?

What types of fossils did she find?

How did she learn about fossils?

Why were her finds so important?

Why do you think she was not credited with finding the fossils?

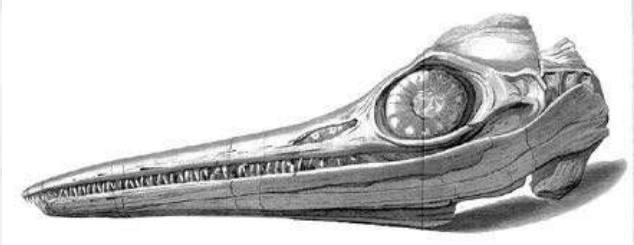
Click me to watch the video!

Mary Anning and Palaeontology

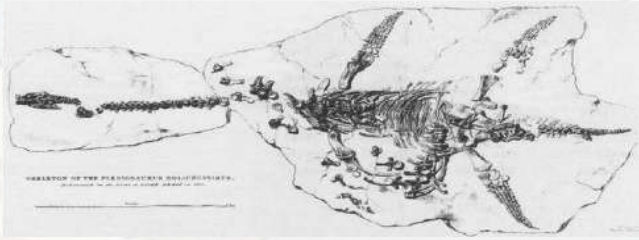
In Mary Anning's lifetime palaeontology (the study of fossils) was still a very new field of ideas and theories.

The fossils Mary Anning found were important for a number of reasons:

- Her major finds included the first ichthyosaur skull (and then whole skeleton), a complete plesiosaur skeleton and a partial skeleton of a pterosaur.
- The fossils provided evidence for the ideas of the early palaeontologists.



Ichthyosaur skull



A sketch of a plesiosaur

Mary Anning and Palaeontology

- Many scientists visited Mary Anning and she was able to help them understand more about the fossils she had found.

- She discovered 'bezoar' stones in the abdominal area of the ichthyosaur. These contained fish bones. She discussed her findings with William Buckland (a geologist and palaeontologist) who identified them as faeces and named them coprolites (which is now a type of trace fossil).

A model of a plesiosaur

Mary Anning and Palaeontology

The area where she collected her fossils is now known as the Jurassic Coast, due to the large number of pre-historic sea creatures found in that area.

She didn't chance upon the fossils. She realised that they were found at the Blue Lias cliffs.
These cliffs are made from layers of shale and limestone which formed over 200 million years ago!

As with all discoveries, there is an element of chance. Mary Anning lived in Lyme Regis.

Mary Anning and Palaeontology

She also knew to search after a storm, as this eroded the rocks. This made it easier to hunt for fossils as they became more exposed.

In addition, she knew that she would have to search soon after the storm so that the smaller fossils were not washed away to the sea.

She was most definitely an expert fossil hunter!

Palaeontologist

Would you want to be a palaeontologist?

Why? Why not?

Palaeontology Reading Comprehension

Read through this reading comprehension and answer questions on the answer sheet.

Fossil Hunting Then and Now

Finding fossils was, and still is, a dangerous activity. Falling rocks, slippery and sometimes unstable surfaces mean that it is necessary to take precautions when finding fossils.

Mary Anning narrowly missed being killed by a landslide (where lots of rocks fall at once from the cliff). Unfortunately her dog Trey was buried underneath the rocks and died as a result.

Modern palaeontologists don't often go out searching for fossils like Mary Anning did. They search existing sites where fossils have been found. They take safety precautions, like wearing a hard hat and checking the times of tides, so they don't become isolated in remote locations.

New fossils sites are usually found by accident by people who are not palaeontologists at all.

Palaeontology has come a long way since Mary Anning's time.

We now know that there were animals who lived millions of years ago, the most fascinating of which are the dinosaurs!

We understand more about dinosaurs, how they might have looked, what they ate and how they lived.

It is thought that the dinosaurs became extinct due to a falling asteroid. The impact of the asteroid was so huge that it changed the climate (weather) around the world.

The climate became colder and the dinosaurs were unable to survive.

Did You Know?

Not all dinosaurs are dead! All the birds (including chickens) that are alive today are related to those dinosaurs! Even the dinosaurs that did not fly, like the T-Rex, have similarities with modern birds, including hollow bones!

Palaeontology Reading Comprehension Question Sheet

Read the Palaeontology Reading Comprehension and then answer the following questions.

Q1. What are palaeontologists?

Q2. What kind of animals lived millions of years ago?

Q3. What does the word 'extinct' mean?

Q4. Why did Mary Anning go fossil hunting when it was not always safe?

Q5. What do modern palaeontologists do to keep safe?

Q6. Why has a 'Did You Know?' box been included?

Extension

- Why don't you research Mary Anning and write a recount of her life? This might be like a biography in the third person (he, she, it, they) or an autobiography of diary entry in the first person (me, my, I)

- https://www.twinkl.co.uk/resource/extraordinary-lives-mary-anning-differentiated-reading-comprehension-activity-t-e-2549584

- https://www.bbc.co.uk/teach/class-clips-video/true-stories-mary-anning/zn7gd6f

You can use these links to learn more about her

Aim

- I can explain how soil is formed.

Success Criteria

- I can state that soil is composed of different things.
- I can describe the 4 processes of soil formation.

Soil

Whole Class

What is soil?

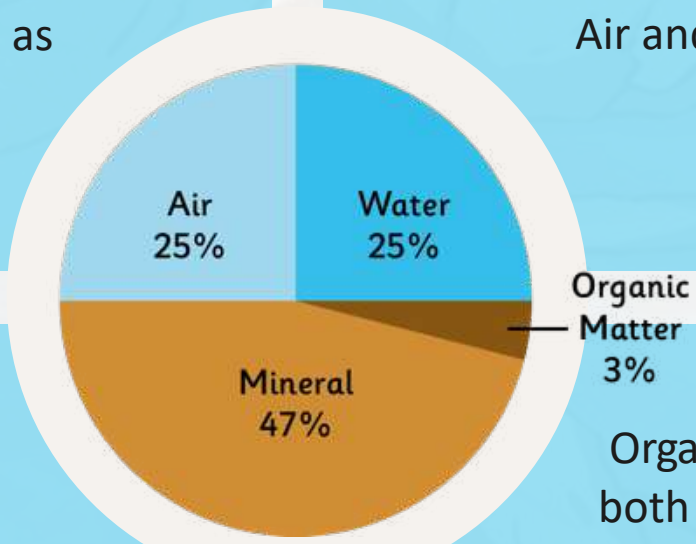
What is soil made from?

What Is Soil Made Of?

Soil is the uppermost layer of the Earth. It is a mixture of different things.

Air
Soil contains gases such as carbon dioxide, oxygen, nitrogen, methane and radon.

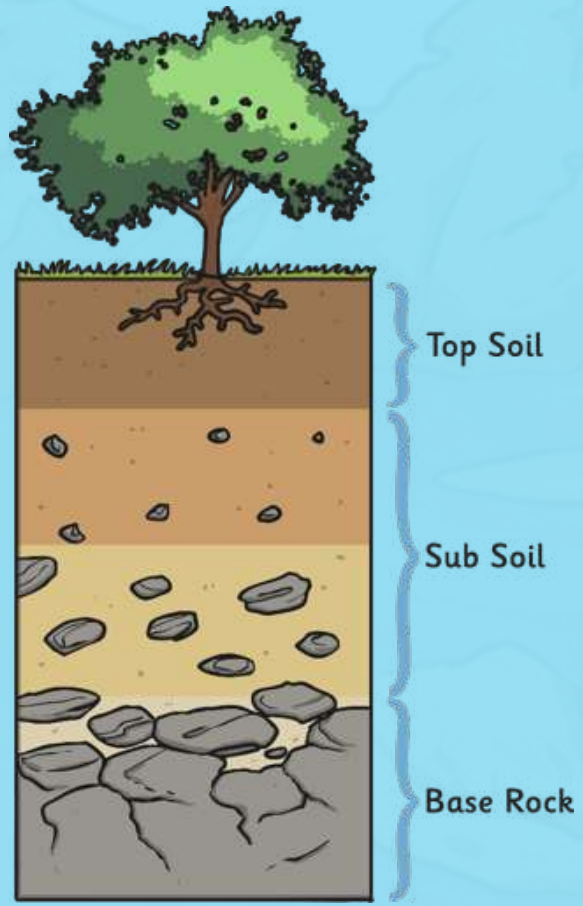
Water
Air and water fill the gaps between particles of soil.



Mineral
The minerals in soil come from finely broken down rock.

Organic Matter
Organic matter includes both living and decaying animals and plants.

Layers of Soil



Soil Formation

There are 4 main processes involved in soil formation:

Additions

Losses

Translocations

Transformations

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Soil Formation
Additions

Rainfall adds water.

Dust adds minerals.

Animal waste adds organic matter and nutrients.

Decaying plants and animals add organic matter.

Humans add fertiliser. Fertilisers contain minerals and nutrients. Natural fertilisers are made from animal waste and organic matter. Human-made fertilisers are made from chemicals.

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Soil Formation
Losses

Water evaporates (turns into gas when hot) into the air.

Soil particles can wash away in storms.

Organic matter can turn into the gas carbon dioxide.

Nutrients and Minerals are taken up by plants and can drain into groundwater.

Photo courtesy of Walter Baxter (@geography.org.uk) - granted under creative commons licence – attribution

Soil Formation
Translocations

Translocations are movements within the soil.

Gravity pulls water down from top to bottom.

Evaporating water draws the minerals up from the bottom to the top.

Animals living in the soil move the soil around in every direction.

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Soil Formation
Transformations

Transformations occur when something changes into something else.

Humus is what is left when dead leaves decompose.

Weathering causes hard rock to erode and turn into smaller and smaller pieces of rock.

Oxygen **reacts** with the minerals such as iron which can make the soil look a reddish, 'rusty' colour.

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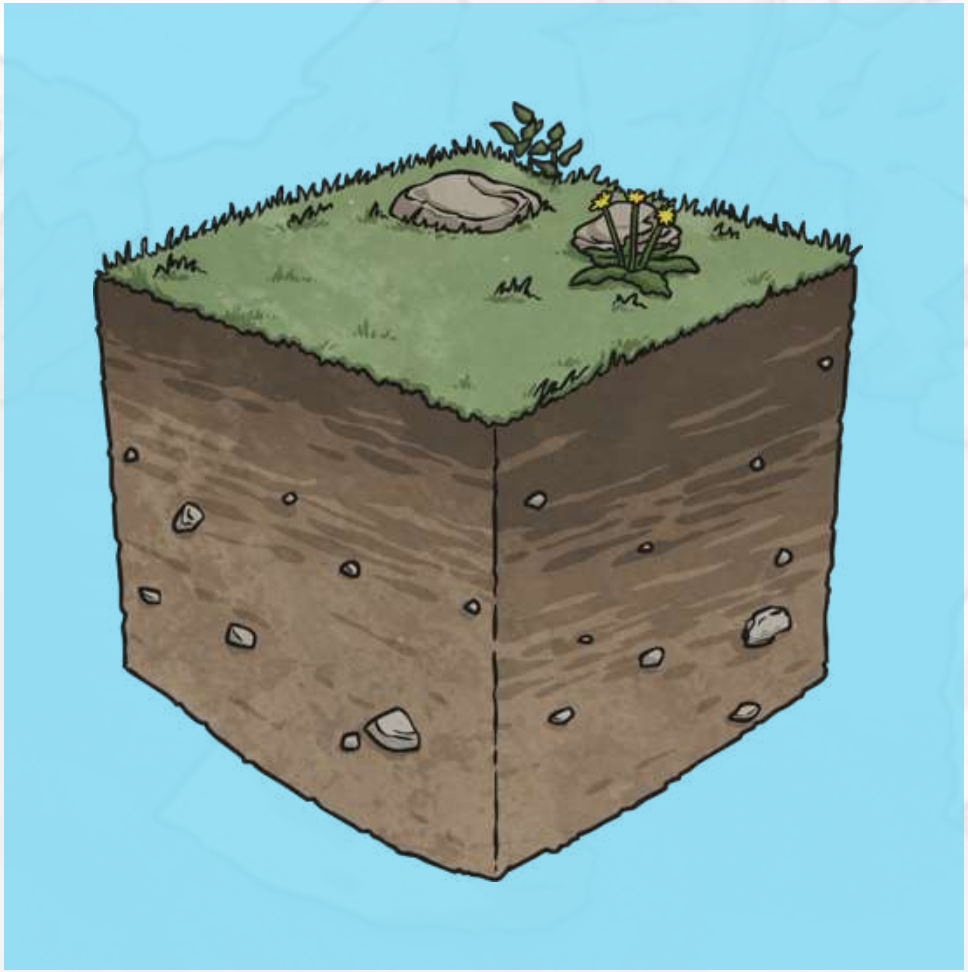
Soil Formation

All four processes are taking place at the same time all the time!



Compost

Compost is organic matter that has been decomposed so that it can be recycled as natural fertiliser.

Many people choose to have a compost bin at home as they see it as more environmentally friendly to recycle waste food rather than throw it away.

It also means they can create their own fertiliser for soil in their garden or for plants, rather than buying it.
You will now have a go at creating your own mini compost bin complete with worms!

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Explanation text

Create an explanation text to explain how soil is formed. Use the following 4 subheadings: additions, losses, translocations and transformations.

Don’t forget to include an introduction where you tell the reader what soil is.

Aim

- I can observe carefully and systematically.
- I can present my findings using scientific vocabulary.

Success Criteria

- I can identify how to make careful observations.
- I can observe how much water has filtered through different types of soil.
- I can use the same equipment and length of time for each observation.

Rocks Quiz

How many different types of rock are there?

A 4 ✗

B 3 ✓

C 5 ✗

Reveal answer

Rocks Quiz

Which of the following is not a type of rock?

A Chalk ✓

B Igneous ✗

C Metamorphic ✗

Reveal answer

Rocks Quiz

What is the name of rock that is formed from lava or magma?

A	Metamorphic rock	✗
B	Igneous rock	✓
C	Sedimentary rock	✗

Reveal answer

Rocks Quiz

What type of rock is created on the seabed?

A	Metamorphic rock	✗
B	Igneous rock	✗
C	Sedimentary rock	✓

Reveal answer

Rocks Quiz

What type of rock is granite?

A Metamorphic rock ✗

B Igneous rock ✓

C Sedimentary rock ✗

Reveal answer

Rocks Quiz

Which of the following statements is true?

A	Metamorphic rock is formed from sedimentary rock.	✗
B	Metamorphic rock is formed from igneous rock.	✗
C	Metamorphic rock can be formed from both igneous and sedimentary rock.	✓

Reveal answer

Rocks Quiz

What is permeability?

A	How hard-wearing the rock is.	✗
B	How easily the rock splits.	✗
C	Whether water can pass through the rock.	✓

Reveal answer

Rocks Quiz

What part do rocks play in forming soil?

How many types of soil do you think there are and why?

Correct Answer: There are hundreds of different types of soil, however there are 6 main types of soil that you will focus on in this lesson.

Why do you think there are hundreds of different types of soil?

Why might soil contain some types of rocks more than others?

Matching Rocks and Soils

In pairs, match soils and the rock(s) they are formed from.

Clay Soil

Clay

Matching Rocks and Soils

Sandy Soil

Sandstone

Matching Rocks and Soils

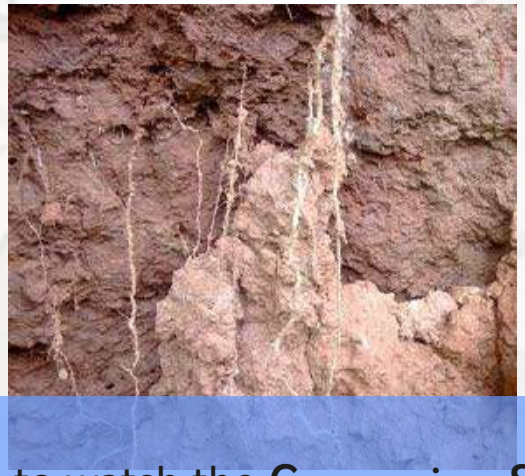
Chalky Soil

Chalk

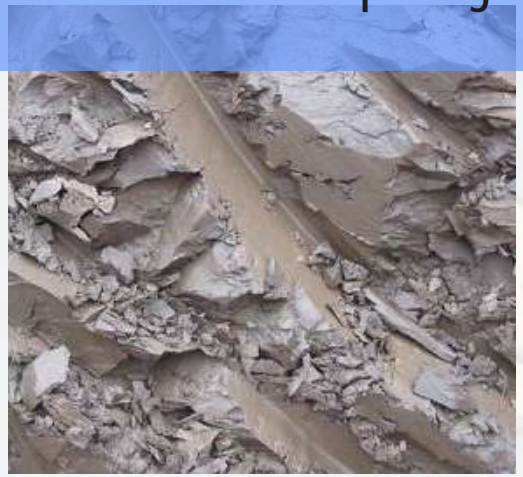
Matching Rocks and Soils

Matching Rocks and Soils

Comparing Soils


Click here to watch the **Comparing Soils Video.**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Create you own quiz

Create your own quiz about everything you have learn about rocks, paleontologists and soils. Test your family on everything you have learnt! Don’t forget to write down the answers so you can mark their work.

You might even use some of the pictures from this PowerPoint to have a pictures round!

Create you own fact file

Create your own fact file or non-chronological report based on the rocks and soils you have found out about!

https://www.twinkl.co.uk/resource/t2-g-008-rocks-and-soils-fact-pages

https://www.twinkl.co.uk/resource/types-of-soil-fact-sheet-t2-t-10000461

Use these link to give you more information