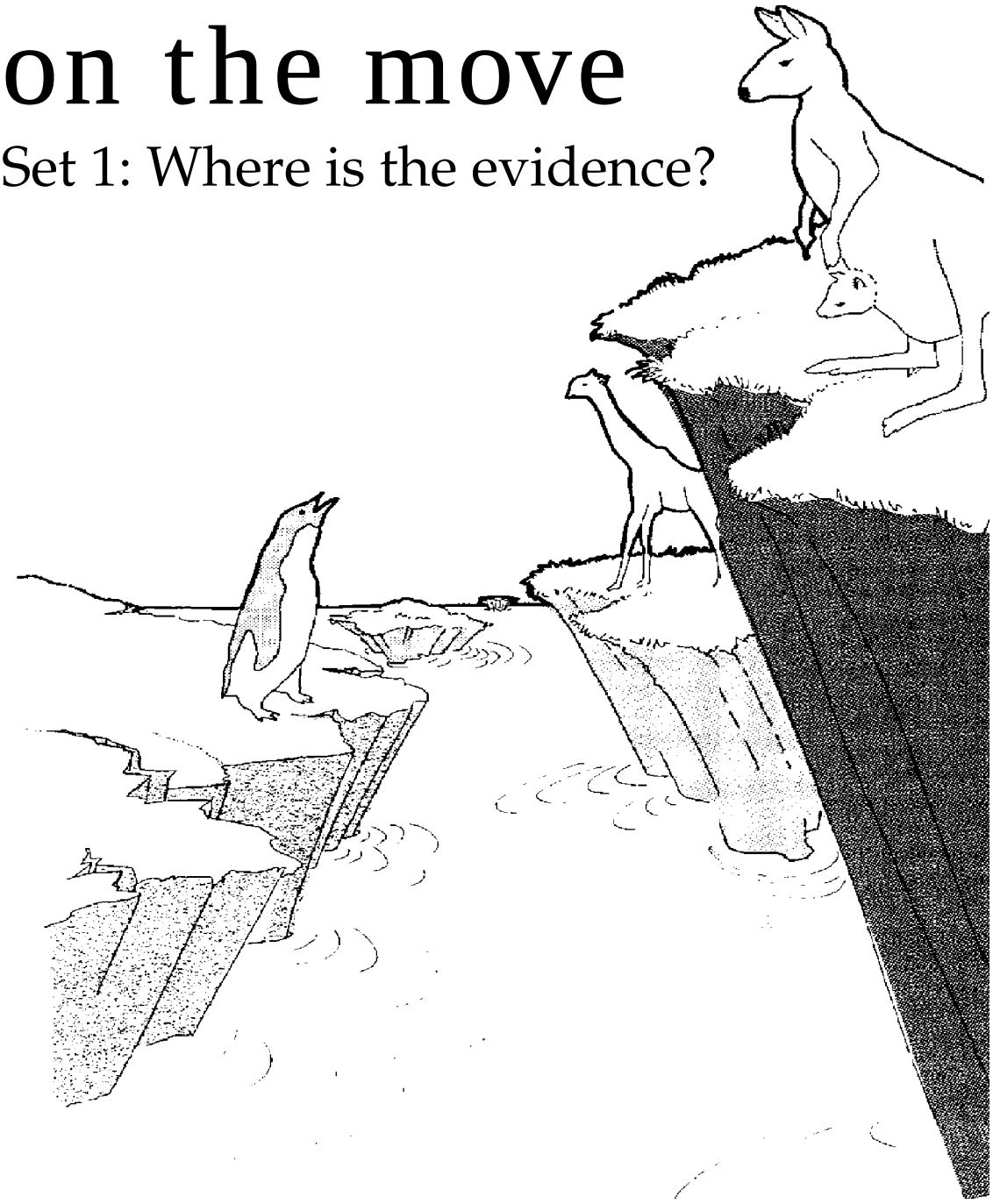
Science Stage 5

Set 1: Lessons 1 to 6

NEW SOUTH WALES DEPARTMENT OF EDUCATION AND TRAINING

Continents on the move

Set 1: Where is the evidence?



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Continents on the move

Here are the names of the lessons in this unit.

Set 1: Where is the evidence?

Contents

What will you learn in Set 1?

At the end of this set, you should be able to:

- identify information that can be used as evidence
- use evidence to test statements
- distinguish between observations and inferences
- explain the difference between observations and inferences
- make observations of rocks
- use observations of rocks to classify and name them
- use observations of rocks to make inferences about how the rocks formed
- describe how igneous rocks form
- describe how sedimentary rocks form
- identify igneous rocks as containing joined crystals
- define the terms fossil and extinct
- match diagrams of organisms with diagrams of fossils
- list some conditions needed for fossils to form
- use fossils to infer the environment present when a sedimentary rock formed
- use fossils to estimate the age of rocks containing them
- explain why people from different times could make different observations of fossils
- complete a summary for Set 1
- describe how metamorphic rocks form
- list the three types of rocks.

Lesson 1

Believe it or not?

Do you always believe everything you are told?

If not – why? What types of things do you think about before you decide whether a statement is true or false?

In the following activity you are going to look at the sorts of things you would consider.

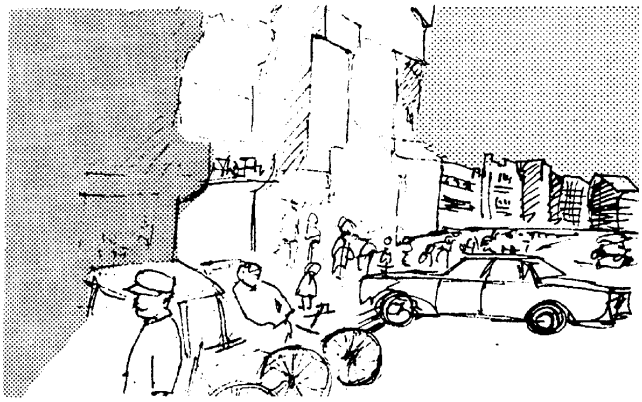
Read the following section carefully and then answer the questions. Write your answers in the spaces provided.

A traveller's tale

A group of students has just returned from their Christmas holidays. They are trying to decide who had the most exciting holiday.

Ann says that she visited Europe in the holidays. She tells the other students about her visit to France. She shows them some French coins and some photographs of the Eiffel Tower.

James tell his classmates that he visited the United States in the holidays. He shows his friends his airline tickets and a photograph of his family standing in front of Bryce Canyon.



John says that he went to Singapore. He tells the other students that Singapore is a very busy city and that it was very hot while he was there.

Michelle says that she does not believe Ann, James or John. She tells them that they are making up stories to impress the other people in the class.

What do you think?

Complete the following table. Think carefully about your answers before you write them down.

Name of student	**Did you believe his/her story? Yes or no?**	**Give a reason for your answer.**
Ann		
James		
John		

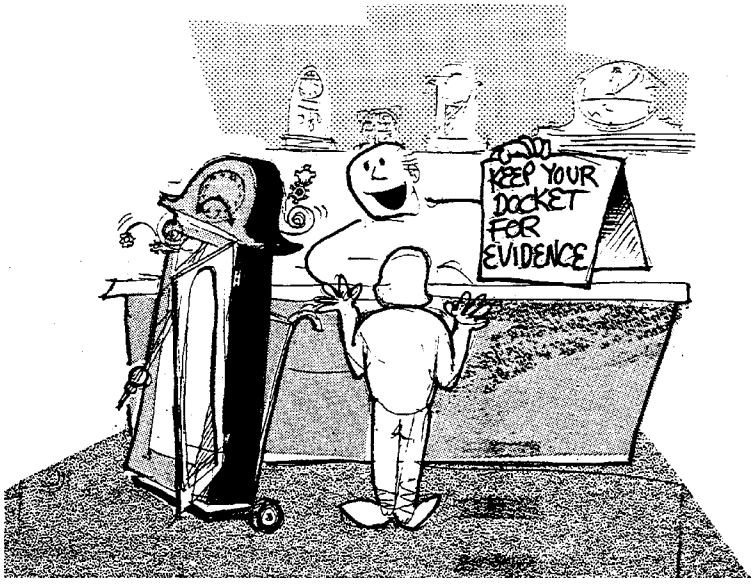
You'll use your answers when you complete send-in Exercise 1.

You really need some evidence before you can make a decision, don't you?

The lesson continues on the next page.

What about some evidence?

Have you ever bought something from a shop and found that it did not work?



If this happens, you usually take the item back to the shop. Hopefully, you can get a replacement or you may want to get your money back. To do this, you need a docket or receipt to prove that you made the purchase.

Because the docket helps to prove that you bought the item, we say that the docket is evidence.

Evidence is anything which helps to prove that something happened. We are more likely to believe someone if they have evidence to support their claim.

Let's now look back at the statements made by Ann, James and John.

Send-in page Name _____

Lesson 1: Believe it or not?

Exercise 1 What about some evidence?

1. Read back through the stories of Ann, John and James. Decide whether these students provided any evidence for their statements. If they did, write the evidence in the table below.

Student	What evidence was provided?
Ann	
James	
John	

2. Could any of the students have obtained their evidence without going overseas? If so, which ones?

_____

3. Do any of the students have evidence which proves that they went overseas in the holidays? Yes or no? _____

   If they do, write the student's name and evidence below.

_____

_____

4. Now, which student(s) do you believe? Write the name(s) below.

_____

Remember that this is a send-in page.
When you have finished this set, return this page to your teacher.

Lesson 2

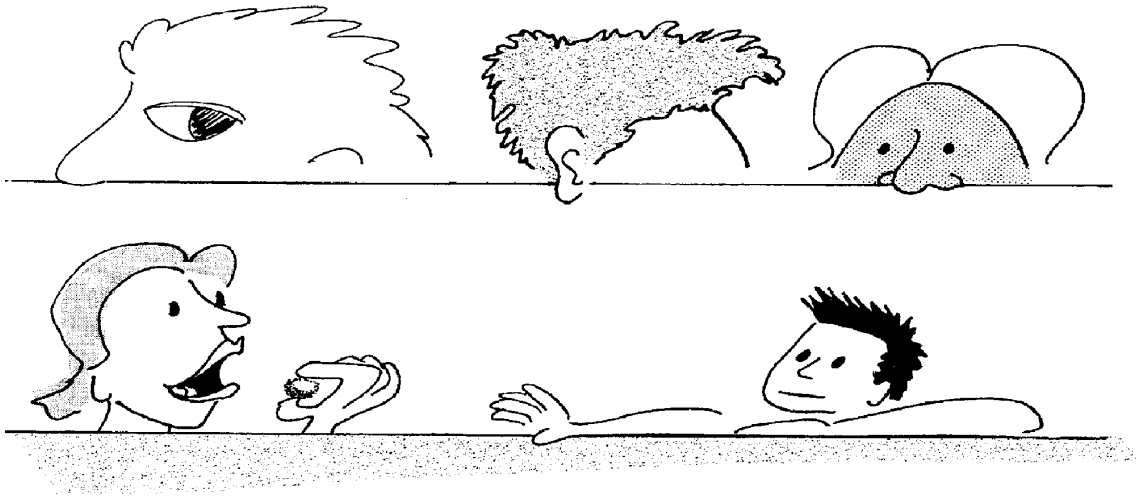
Using evidence

Everyone knows that police use evidence.
When they are trying to solve a crime,
they collect many different pieces of information.
They use this information to work out what happened.
The evidence that they collect is very important.

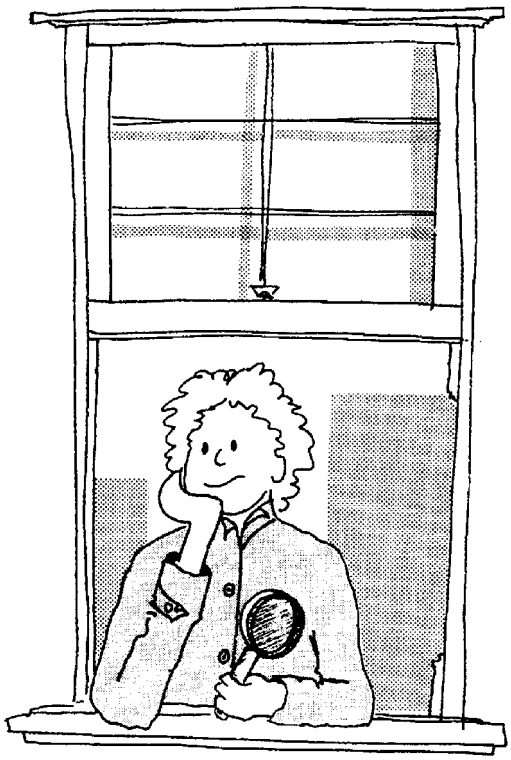
There are many different types of evidence.
When police go to the scene of a crime they look for fingerprints, footprints, traces of blood or anything that the criminal may have left behind. The detectives look around and make careful observations.

An **observation** is something
you find out by using your senses.

You make observations by seeing, hearing, smelling, tasting or touching.



Now read through the following example



Detectives at the scene of a robbery made the following observations.

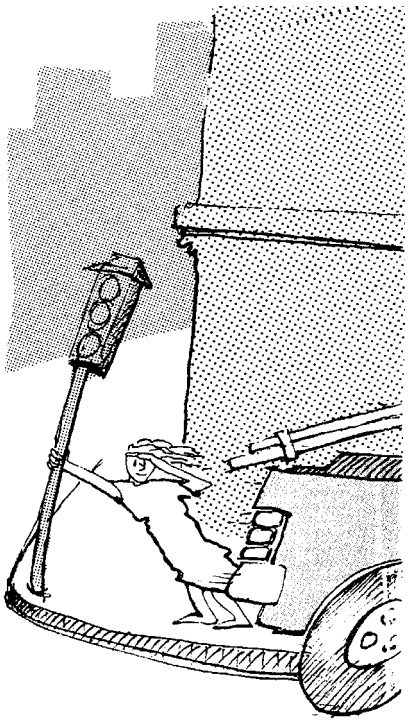
- Some footprints were found in the garden.
- There is a piece of wood missing from the window sill in the library.
- The carpet near the library window has mud on it.

These observations were made using the sense of sight.

From their observations, the police decided that the thief entered the house through the library window.

This is not an observation. The detectives did not see the thief enter the house. Using their observations, they have tried to work out what happened.

A statement that tries to explain what has been observed is called an **inference**.



Think about this example

Debbie sees a fire engine drive past with its light flashing and its siren going.

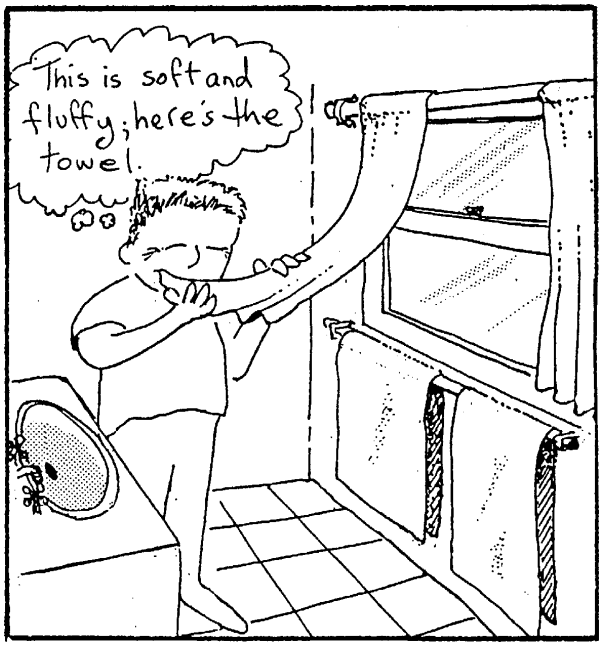
- **What observations did she make?**
  - A fire engine has driven past.
  - Its light was flashing and its siren was going.
- **What senses did she use?**
  - Debbie used the senses of sight and hearing.
- **What inferences could be put forward to explain this?**
  - There is a fire somewhere, or
  - there has been a bad accident and dangerous chemicals are leaking, or
  - the fire brigade is on a practice run.

Debbie does not know which of her inferences is correct. She does not have enough evidence.

Do you understand the difference between
an observation and an inference?
Test yourself by doing the following mastery test!

Mastery test 1
Observation or inference?

1. Gerry has washed his face.
   He has soap in his eyes so he can't open them.



(a) What observation has he made?

_____

(b) What sense did he use to make this observation?

_____

(c) What inference did he make?

_____

(d) Was his inference correct? Yes or no?

_____

2. Mr Brown reports that someone has stolen a package of meat from his front porch. A detective goes to investigate.

   She makes the following observations.

   – A trail of muddy footprints leads from the porch to the backyard.

   – Scraps of meat are found in the backyard.

   – The paper that the meat was wrapped in is found in the dog's kennel.

   Write down one inference that you could make to explain these observations.

   _____

   _____

   _____

   _____

3. Mr Jones walks into a doctor's surgery and tells the doctor he has a sore head.

   The doctor takes Mr Jones' temperature and finds that it is very high. The doctor looks at Mr Jones' legs and arms. They are covered with yellow spots. Mr Jones says that the spots are very itchy.

   The doctor tells Mr Jones that he has chicken pox. He says that Mr Jones must go home and go to bed.

   Look at the following statements made by the doctor and Mr Jones. Decide whether each statement is an observation or an inference. Put a tick (✓) the correct column.

Statement	**Observation**	**Inference**
Mr Jones has a sore head.		
Mr Jones has chicken pox.		
Mr Jones has itchy spots.		
Mr Jones has a high temperature.		
Mr Jones will get better if he goes to bed.		

Check your answers to all the questions in this mastery test using the solutions in the answer pages.

Now go on to the problem on the next page.

There is a thief in the house!

Paolo and Nick wake up suddenly.
The dog is barking and growling loudly.

Nick grabs his torch and they creep to the kitchen to investigate.

Nick shines the torch out into the yard.

Look at the statements on the following send-in page.
Decide whether each statement is an observation or an inference.

Put O in the box next to any of the statements that are **observations**.

Put I in the box next to any that you think are **inferences**.

Send-in page Name _____

Lesson 2: Using evidence

Exercise 2 There is a thief in the house!

1. Are the statements below observations (O) or inferences (I)?

- ☐ Paolo and Nick heard growling and barking.
- ☐ The dog was trying to frighten the thief.
- ☐ A thief had opened the kitchen window.
- ☐ The fruit bowl was knocked over.
- ☐ The thief was trying to climb in at the window.
- ☐ There was no-one in the yard.
- ☐ There was a possum in the tree.
- ☐ The possum had stolen an apple.
- ☐ The dog was barking at the possum.

2. Explain the difference between an observation and an inference.

_____

_____

_____

_____

Remember to send this page to your teacher when you have finished this set.

Lesson 3

Evidence from rock

Police are not the only people who need to make observations and inferences. Doctors, mechanics and plumbers are some of the many people who, during their work, use observations to make inferences. All of these people need to collect evidence to help them solve problems.

Scientists are problem solvers too. They solve many different types of problems. Here are some examples.

- Scientists are decoding DNA (genetic material) from many organisms, with the hope that they can improve the characteristics of some organisms and prevent diseases.
- Scientists are trying to discover a vaccine for AIDS and malaria. They are looking for new drugs that will treat other diseases too.
- Scientists are investigating microorganisms that could be used to clean up oil slicks and contaminated soil.
- Because of global warming, scientists are seeking alternative chemicals and production methods to reduce damage to the ozone layer.
- Scientists know that cells are the building blocks of living things, and minerals are the building blocks of rocks. But what are the basic building blocks of atoms? Scientists are looking for the answer.
- Scientists are trying to find out why our universe is expanding and how gravity is involved in this.

These are just some of the many scientific research projects that are occurring around the world.

And there are other scientists who are trying to find out what happened in the Earth's past.

How is it possible to learn about something that happened millions of years ago? Scientists cannot observe what happened. However, they can look at the rocks that were formed millions of years ago and use these to infer what happened when the rocks were formed.

Let's look at some information that you can get by looking at rocks.

Types of rocks

There are three main types of rocks. They are:

- igneous rocks
- sedimentary rocks
- metamorphic rocks.

Each of these rock types is formed in a different way. Each rock type tells you about a process that happened in the Earth's past.

Igneous rocks

Igneous rocks are rocks that form when melted, or molten, rock cools. This molten rock comes from deep within the Earth.

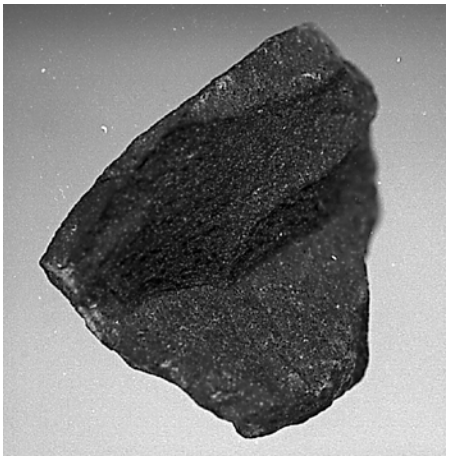
You can recognise igneous rocks because they contain crystals. These crystals join into each other and cannot be rubbed off.

The size of the crystals tells you where the rock formed.

If the molten rock reaches the surface, it erupts as **lava**. The layers of lava can build up to make a volcano.

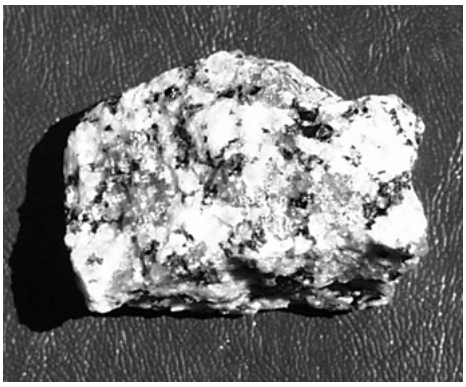
Lava loses its heat to the air and cools quickly. Fast cooling produces rocks with small crystals.

Basalt is a dark-coloured igneous rock with tiny crystals. The crystals are so small that you need a hand lens to see them. This means that the rock formed when molten rock cooled quickly, usually in a lava flow.



Wherever there is basalt, you can infer that there was probably a lava flow in the past.

If the molten rock does not reach the surface, it cools slowly underground. Slow cooling produces an igneous rock with large crystals.



Granite is an igneous rock which cooled in this way. It has large, joined crystals.

Igneous rocks with large crystals form deep underground.
To be seen at the surface, the rocks which lie on top of them must be worn away or the granite must be pushed up to the surface.

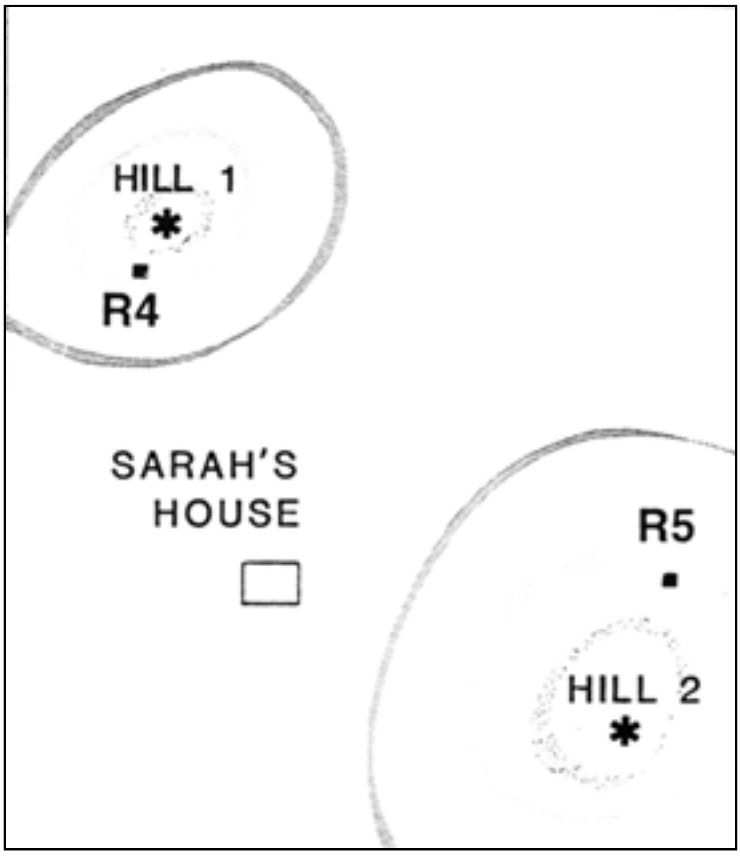
Now try a problem that uses this information.

Searching for volcanoes

Sarah has been told that one of the hills near her home was once an active volcano. She decides to find out which one it was.

Sarah decides that the best way of solving this problem is to look at the rocks on each hill. She labels rocks as she collects them so that she can study them at home.

Two of the rocks she collects are Rock 4 (R4) and Rock 5 (R5). The map below shows where Sarah collected these rocks.



Use the information above and the rocks to complete the following send-in page.

Send-in page Name _____

Lesson 3: Evidence from rock

Exercise 3 Searching for volcanoes

Look at the photos of Rock 4 and Rock 5 that Sarah collected.
You will notice that both of these rocks are made of joined crystals.

1. What type of rock is made of joined crystals?

   _____

2. How do these rocks form?

   _____

   _____

Look at Rock 4. It was found at the point marked R4 on the map.

3. Does Rock 4 have large or small crystals?

   _____

4. Make an inference about the rate at which Rock 4 formed.
   Which of these inferences could be correct? (Underline your choice.)
   (a) Rock 4 cooled quickly.
   (b) Rock 4 cooled slowly.

5. Where would this rock have formed?

   _____

This send-in exercise continues on the next page.

Now look at Rock 5. It was found at the point marked R5 on the map.

6. What are two ways in which Rock 4 and Rock 5 are different? (Different size and shape do not count.)

   - _____
   - _____

7. How would Rock 5 have formed?

   _____

8. Which rock was formed by a volcano?

   _____

9. Now, which hill do you think was the volcano – Hill 1 or Hill 2?

   _____

Lesson 4

Big rocks from little rocks

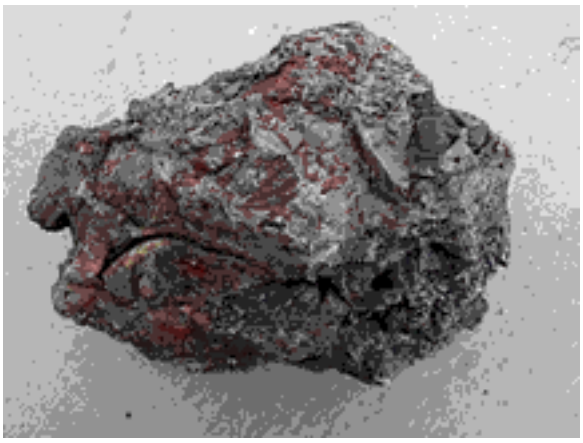
Not all rocks are made of joined crystals. Instead, some rocks contain particles that are stuck, or cemented together. These particles are usually rounded but they can be irregular shapes because they have been broken off other rocks (rock fragments) or are fossils formed from living things.

Geologists give different-sized particles different names. For example, clay is a particle size smaller than sand and sand-sized grains are smaller than gravel grains.

When particles break off rocks, they are carried away by wind and water. They are called **sediments** because they tend to settle in layers when the wind or water slows.

Sedimentary rocks form when the particles within layers of sediment are cemented together.

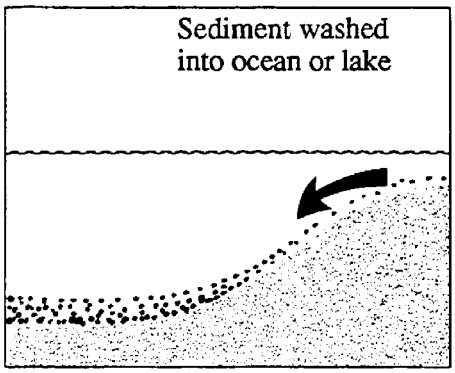
This sedimentary rock is made of sand-sized grains.



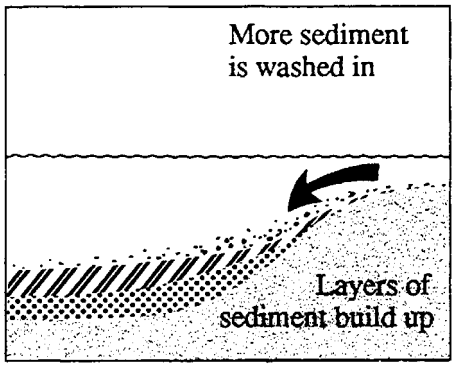
This rock is made of shell fragments.

How are sedimentary rocks formed?

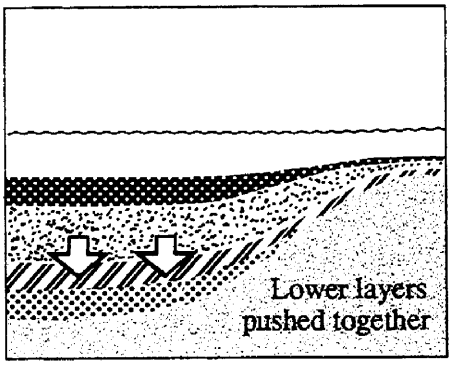
Most sedimentary rocks form when rivers or tides wash rock fragments and sometimes the remains of living things into an ocean or lake. (Layers of rock fragments can also form when they are blown by the wind.)



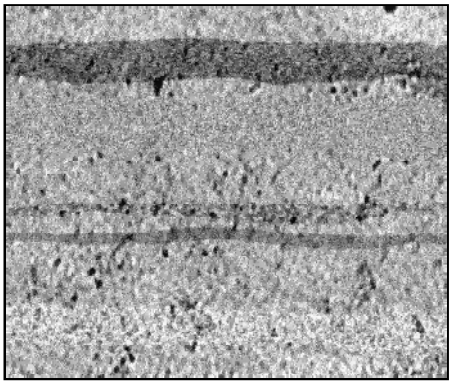
Over a long period of time, more sediment is washed in. Layers of sediment are gradually built up.



As the sediment gets thicker, the weight of sediment on top pushes down on the particles in the lower layers, compacting (squashing) them together.



But fluids can move through the sediment, between the particles. The fluids deposit chemicals in the gaps. These chemicals form a sort of glue that cements the particles together.



Sedimentary rocks are compacted layers of sediment with the particles cemented together. Layers of sediment can still be seen in many sedimentary rocks.

Mastery test 2
Igneous or sedimentary?

The purpose of this mastery test is:

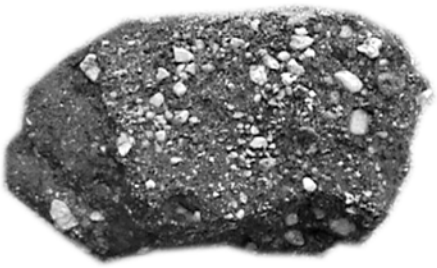
- to see if you understand how sedimentary rocks are formed
- to see if you understand the difference between igneous rocks and sedimentary rocks.

Use information from Lesson 3 and Lesson 4
to complete this mastery test.

1. Draw an arrow to match each box on the left with the best meaning.

lava	a structure built up from layers of lava or sometimes ash
sedimentary rock	molten rock that erupts onto the Earth's surface
volcano	material which is moved by water or wind
igneous rock	compacted layers of sediment, with particles cemented together
sediment	formed by the cooling of molten material

2. Look at the following photograph of a rock specimen.



This rock is made of rounded pebbles packed together with clay-sized particles.

(a) Would you class this as an igneous rock or a sedimentary rock?

_____

(b) Give a reason for your answer.

_____

_____

3. (a) A student named Chris is studying another rock specimen. He has made the following notes in his science book.

☐ This rock contains large crystals that are joined together.

☐ This rock is pinky-grey in colour.

☐ This rock was formed by the cooling of molten material.

☐ This rock contains several different minerals.

☐ This rock cooled deep underground.

Decide whether each of Chris' statements is an observation (O) or an inference (I). Write your answers in the boxes.

(b) Is this an igneous rock or a sedimentary rock?

_____

(c) Give a reason for your answer.

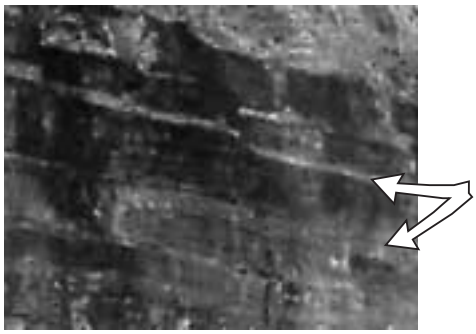
_____

_____

Now check your answers by looking at the solutions in the answer pages.

Types of sedimentary rocks

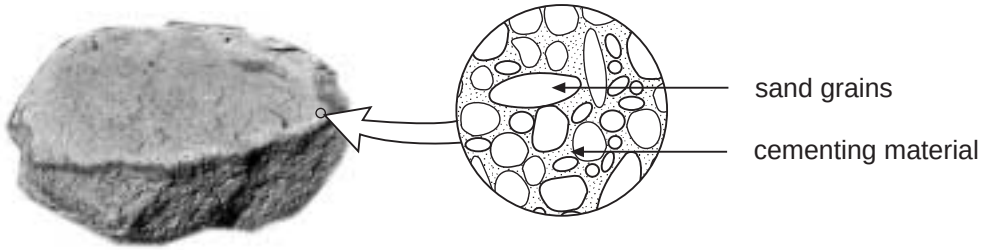
There are many different types of sediment. This means that there will be many different types of sedimentary rocks. Let's look at some examples of different sedimentary rocks.



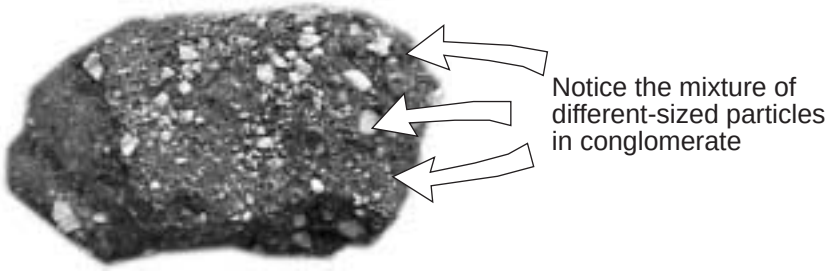
Shale and **mudstone** are rocks formed from clay and mud. These sediments are deposited, or laid down, in very still conditions such as a deep ocean or the middle of a lake.

Deposited and **laid down** are ways to say that sediments settle to the bottom in layers.

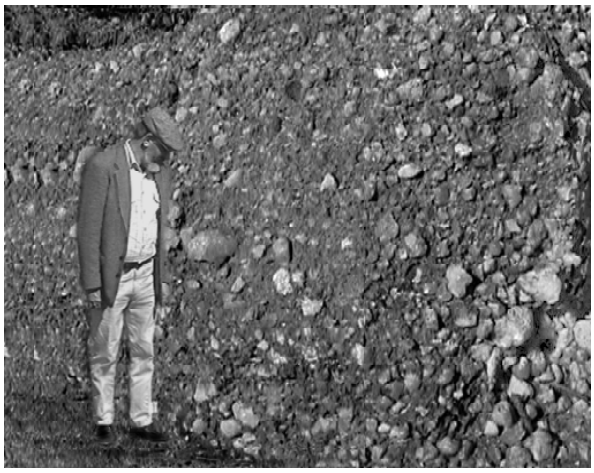
Sandstone is made of grains of sand stuck together with cementing material. Sandstone forms from sand-sized grains deposited underwater, either along the coast or in rivers or lakes. Some sandstone is formed when wind blows sand into sand dunes.



Conglomerate is a rock made from smooth pebbles, clay and sand. If you find some conglomerate, you can infer that the area was once the bed of a fast-moving river or a seashore with strong currents.



One of the most unusual sedimentary rocks is **tillite**. It contains a mixture of different-sized particles, ranging from tiny pieces of clay to enormous boulders.



Tillite is formed by glaciers (ice rivers). As the glacier moves along it picks up pieces of rock from the valley floor. The sand, pebbles and boulders picked up by the glacier are dumped at the end of the glacier when it melts.

Some sedimentary rocks are formed from the remains of living things.

Limestone can be formed from coral. Coral only grows in warm, shallow seas and often builds up large coral reefs. If you find limestone, you can infer that there must have been a warm, shallow sea at that place in the past.

Coal is formed from layers of plant material usually laid down in tropical swamps. Water brings sediment that is deposited over the plant material. Eventually, shiny, black coal forms.

Today's coal deposits formed from swamps such as this.

Send-in page Name _____

Lesson 4: Big rocks from little rocks

Exercise 4.1 Which sedimentary rock is that?

1. Use information from this lesson to complete the summary table below. The first row has been completed for you as an example.

	Name of rock	What type of material makes up this rock?	In what environment was the material laid down?
e.g.	shale	clay or mud	very still conditions: deep ocean or the middle of a lake
	sandstone		
		plant material	tropical swamp
	limestone	coral	
			sediment is dumped by a melting glacier
		pebbles, sand and clay	

2. Use the table to write summary sentences about two of these sedimentary rocks. An example has been completed for you.

e.g. Shale is made of clay or mud that was laid down in very quiet conditions such as a deep ocean or in the middle of a lake.

- _____

  _____

- _____

  _____

Exercise 4.2 Trends and patterns

1. Scientists have placed sedimentary rocks into one group because of their similarities. Looking for patterns in rocks and in the ways they form makes it easier for scientists to remember and use observations about rocks.

   How are all sedimentary rocks similar?
   (Hint: Why are they called sedimentary rocks?)

   _____

   _____

2. (a) Look at Rock R.

   What are two observations that you can make to let you decide that Rock R is a sedimentary rock?

   - _____
   - _____

   (b) What type of sediment makes up this rock?
   Underline the best answer.

   mud sand pebbles rocks coral plants

   (c) How would you infer that this rock formed?

   _____

   _____

   (d) Look back at your summary table in Exercise 4.1.
   What type of sedimentary rock is Rock R?

   _____

Lessons 5 and 6

Fossils

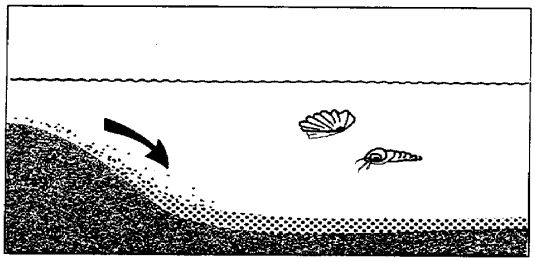
Many sedimentary rocks contain fossils. **Fossils** are the remains or traces of living things that have been preserved in rocks.

There are four basic types of fossils.

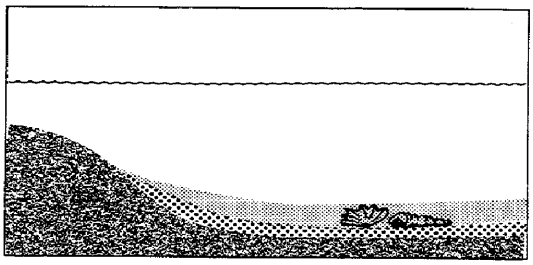
1. Some fossils are the actual remains of living things.
2. Other fossils form when sediment settles over tracks made by an animal.
3. Sometimes only the shape of the living thing is preserved, leaving an empty space behind – a bit like a jelly mould.

4. Many fossils form when plant or animal tissue is replaced by other chemicals. The fossil is made of rock but it has the appearance of the living thing that once was there.

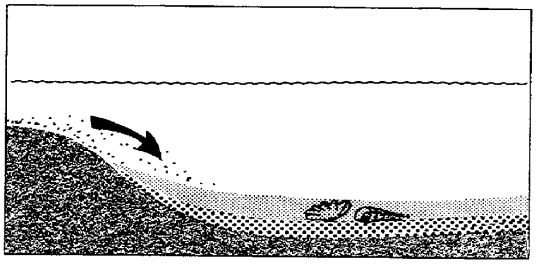
Fossils are formed at the same time that sediment is laid down.
For example, let's look at the way the fourth type of fossil is formed.



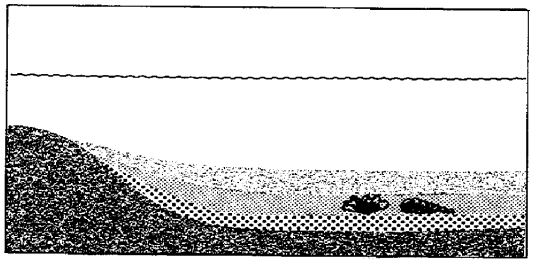
1. Some shellfish live in a shallow sea. Sediment from the land is continuously washed into the sea.



2. The shellfish die and fall to the bottom of the sea. Then they become covered with sediment.

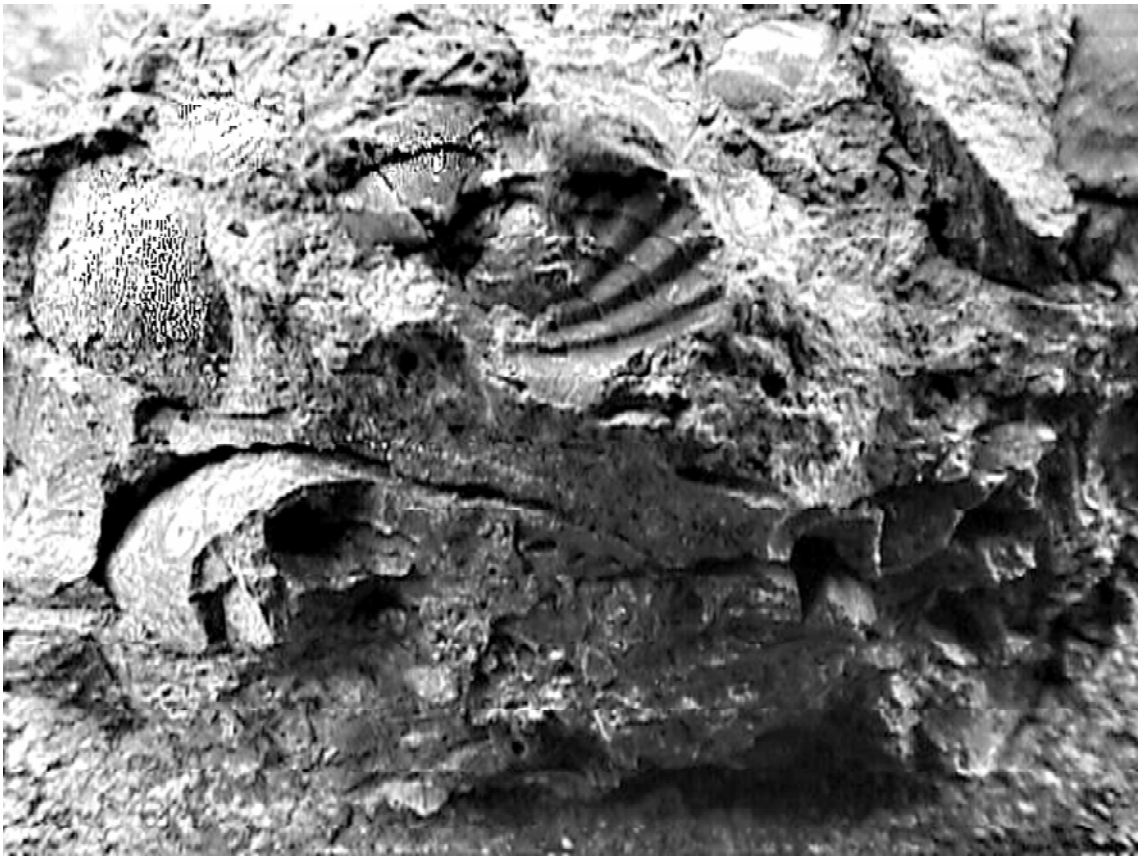


3. Slowly the shells dissolve. A hole is left where each shell once was. Each hole shows the surface marking of the shell.



4. Gradually the hole is filled by chemicals, brought by the fluids that move through the sediment. The chemicals form a solid that is the same size and shape as the shell.

Over millions of years, the sediment is turned into rock.
The impression of the shellfish will be seen
if the rock is broken apart.



Shellfish are not the only animals that are preserved
as fossils. Insects, coral, mammals and of course,
dinosaurs are all preserved in this way!
Plants may also be preserved as fossils.

Scientists who study fossils are called **palaeontologists**.
Their discoveries have changed the way that people
think about fossils.

Over the last three hundred years, palaeontologists
have collected evidence that lets scientists believe
that the things in rocks that look like plants and animals
really are the remains of organisms that once lived on Earth.

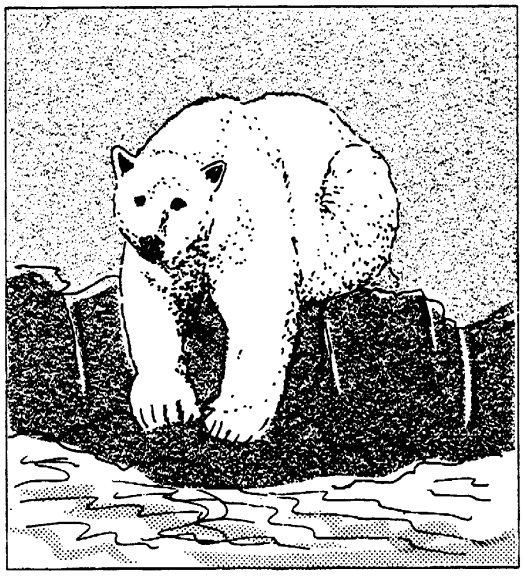
Why are fossils important?

Fossils are not only interesting; they are also very important.
Let's look at two ways fossils give information to scientists.

What was the environment like?

There are an enormous number of different living things
on the Earth's surface today.
Different animals and plants are found in different places.

Most ferns grow where
it is warm and wet.



Polar bears are only found
where it is very cold.

The animals and plants which lived in the past
were also found only in certain types of environments.

For example:

- corals grew only in warm, shallow seawater
- tree ferns usually grew in tropical, fresh water swamps
- some shellfish lived only in freshwater rivers and lakes.

So by looking at fossils, scientists get an idea of the environment
in which sediment was laid down. Fossils also help scientists
infer what the climate was like millions of years ago.

How old is that rock?

The first scientists to study fossils realised that many fossils did not look like living plants and animals. The animals and plants seen in the fossils were no longer found on the Earth's surface. Animals and plants which were once living but have since died out are said to be **extinct**.

As palaeontologists continued their studies, they made some interesting observations.

Some fossils such as trilobites are only found in old rocks. This trilobite fossil was found in rock that is over 280 million years old.

Other fossils, such as this fossil fish, are only found in younger rocks. This fish fossil formed about 200 million years ago.

Ammonite fossils are found in rocks from many different time periods. But this ammonite fossil is only found in rocks about 160 million years old.

Rocks of different ages contain different types of fossils. This means that the fossils found in a rock can be used to deduce (work out) how old the rock is.

Mastery test 3
Making fossils

1. Some sedimentary rocks contain fossils.
   What are fossils?

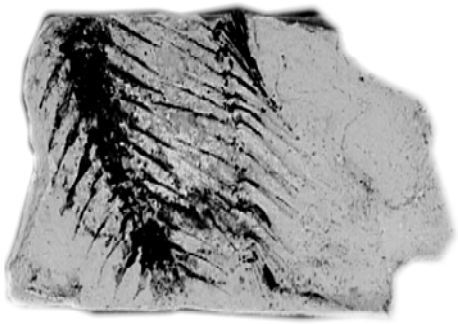
   _____

   _____

   _____

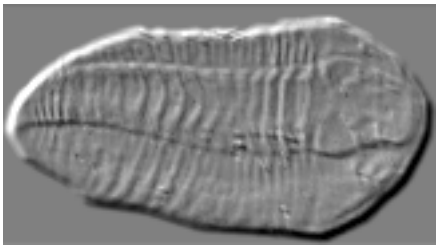
2. (a) Can you name the animals that produced these fossils?

Rock A



_____

Rock B



_____

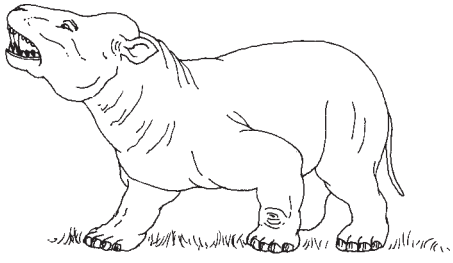
   (b) Which of these rocks is probably older? _____

   Give a reason for your answer.

   _____

   _____

3. Look at the animal shown in the diagram.



   (a) Is this animal living on the Earth's surface today?

   Yes or no? _____

   (b) This animal is said to be extinct.
   What does this mean?

   _____

   _____

4. (a) Look at this fossil fish.
Which parts of the animal
have been preserved in rock?

_____

(b) Are these parts hard or soft? _____

5. There have been billions of billions of living things on the Earth.
Only some of these organisms are preserved as fossils.

Read through the list below. Tick the conditions that you think would be needed for a living thing to form a fossil.

Conditions needed for forming a fossil

- ☐ Layers of sediment are being laid down quickly.
- ☐ The organism is protected from being eaten or rotting.
- ☐ The organism is in water.
- ☐ The sediment layers must not be disturbed until they become rock.
- ☐ The sediment becomes cemented together.
- ☐ The organism lives near a volcano.

6. Use your answers in Question 4 and the statements you ticked in Question 5 to write a description of the conditions under which fossils form.

_____

_____

_____

_____

_____

_____

Please compare your answers with the ones in the answer pages.

Mastery test 4
A summary of Set 1

The following passage is a summary of ideas that you have covered in Set 1. The only problem is that the passage is incomplete!

Use the words below to fill in the blank spaces in the summary. Each word is used once only.

coal	fish	rounded grains	sedimentary
cold	igneous	rocks	quickly
evidence	lava flow	sea	

1. Before you believe a statement, you should always look for _____ to support the claim.

2. Scientists can deduce what the Earth was like millions of years ago by looking at _____ now on the Earth's surface.

3. If you look at rocks you can **observe**:
   - what the rock is made of

     For example, _____ rocks are made of joined crystals.

     Sedimentary rocks contain _____ cemented together.
   - if the rock contains fossils.

     Fossils are usually found in _____ rocks.

The summary continues on the next page.

4. You may be able to use information from observations to **infer**:
   - how the rock formed

     For example, small crystals in igneous rocks indicate that the rock cooled _____ and probably formed in a _____.
   - the types of plants and animals that lived in the area when the rock was being formed
   - how long ago the rock was formed
   - the environment at the time that the sediment was laid down.

     For example, if you find a fossil _____ in a high mountainous area, then you can infer that this land was once under the _____.

     Tillite indicates that the climate was very _____ at the time that the sediment was laid down.

     _____ forms from plants which usually grow in a warm, wet climate.

Now check your answers by comparing them with the ones in the answer pages.

Send-in page Name _____

Lessons 5 and 6: Fossils

Exercise 5 Jonathan studies a fossil

Jonathan's teacher asked him to investigate rocks near his home.
He visited a rock outcrop and took several samples from the outcrop.

1. One of the rock samples was made of layers of sand-sized particles.
   (a) What would be a good name for this rock? _____
   (b) Which words in the description of the rock do you use to decide if this rock is igneous or sedimentary? Underline the words in the sentence below.
   One of the rocks was made of layers of sand-sized particles.

2. Jonathan looked closely at the rock and noticed this fossil.

   (a) Sketch the fossil in the space beside the photograph.
   (b) Describe the conditions that must have existed for an organism to produce this fossil.

_____

_____

_____

_____

3. Jonathan thought that this rock could have formed in either of two ways:

   Idea 1 Mud or clay settled on the bottom of a quiet freshwater lake.

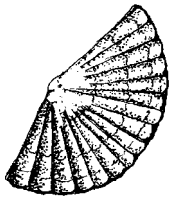
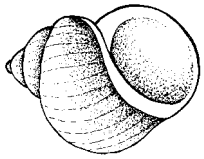
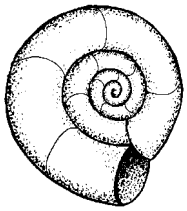
   Idea 2 Mud or clay settled to the bottom of the ocean.

Jonathan thought that the fossil looked like a shell. He decided to try to identify the fossil to give him more information about the rock. Here is some information that he found when he investigated animals with shells that are found as fossils.

Molluscs

Molluscs are soft-bodied animals which have a hard outer shell. There are many molluscs living today. However, some molluscs are only found as fossils.

Some common fossils are shown in the table below.

Mollusc	Where did it live?
 Turritella	Found in shallow seawater, about 20 m deep; burrowed into muddy gravel
 Micromitra	Lived on the bottom of shallow oceans
 Vivaparus	Lived in freshwater streams or lakes
 Planorbis	Lived in freshwater streams or lakes; fed on plants and algae

Send-in page Name _____

Lessons 5 and 6: Fossils (continued)

(a) Use the table on page 38 to identify the fossil that Jonathan found.
Write the name of the fossil.

_____

(b) Where did this animal usually live?

_____

_____

(c) Look back at the two ideas which Jonathan had for the way that the rock was formed.
Which of these ideas is more likely to be correct? Why?

_____

_____

(d) Jonathan has used the fossil to infer what the environment where he lives was like when the rock formed. What else could he find out about the rock by studying the fossil?

_____

4. Jonathan recognised his fossil as the remains of a mollusc that lived long ago. But if the rock had been discovered five hundred years ago, the person would only have seen an interesting pattern.
Why can two people make different observations about the same rock?

_____

_____

_____

The send-in pages for this unit have been spread throughout the lessons.

Check that you have completed these exercises:

- Exercise 1 on page 5
- Exercise 2 on page 13
- Exercise 3 on pages 19 and 20
- Exercise 4.1 on page 27
- Exercise 4.2 on page 28
- Exercise 5 on pages 37 to 39.

Put these send-in pages together and return them to your teacher.

Revision – Completing the rock picture

You have looked at the way in which igneous and sedimentary rocks are formed. Let's now look at the third major group of rocks … the metamorphic rocks.

Metamorphic rocks

The Earth's surface is constantly changing. Sometimes, earth movements cause igneous and sedimentary rocks to be buried deep below the surface.

Heat and pressure at these depths can change rocks.
If new rocks are formed, they are called metamorphic rocks.

Marble, slate and quartzite are examples of metamorphic rocks.

marble

slate

Marble is formed from the sedimentary rock called limestone.

What happens to limestone for it to be changed into marble?

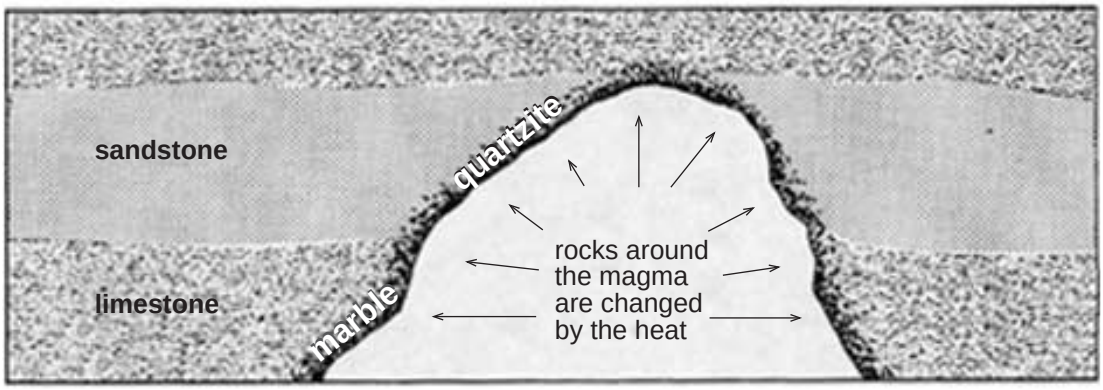
_____

_____

Limestone must be heated and compressed (be put under pressure, or squashed).

Metamorphic rocks can also form
when rocks are 'cooked' by molten rock.
Molten rock below the Earth's surface is called **magma**.

As magma moves up from deep beneath the surface,
heat travels into the surrounding rocks causing changes
in them.



Heat and pressure can change the sedimentary rock
called limestone into marble.

What is the metamorphic rock formed
when sandstone is heated?

_____

The metamorphic rock made from sandstone is quartzite.
(Look carefully at the diagram if you did not know
how to find the answer.)

The three main types of rocks are:

- _____
- _____
- _____

Suggested answers

Lesson 2 ## Using evidence

Pages 9 to 11

Mastery test 1 – Observation or inference?

1. Gerry has washed his face.
   He has soap in his eyes so he can't open them.

   (a) What observation has he made?

   The object that he wiped his face on is soft and fluffy.

   (b) What sense did he use to make this observation?

   He used his sense of touch.

   (c) What inference did he make?

   The soft, fluffy thing was a towel.

   (d) Was his inference correct? Yes or no?

   no

2. Mr Brown reports that someone has stolen a package of meat from his front porch. A detective goes to investigate.

   Write down one inference that you could make to explain the detective's observations.

   The dog had taken the parcel of meat to its kennel.

3. Look at the following statements made by the doctor and Mr Jones. Decide whether each statement is an observation or an inference. Put a tick (✓) the correct column.

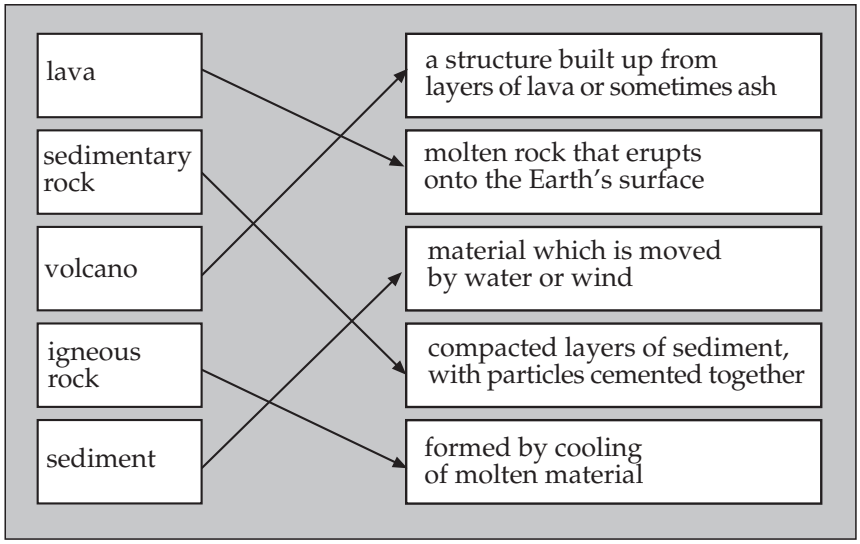
Statement	Observation	Inference
Mr Jones has a sore head.	✓	
Mr Jones has chicken pox.		✓
Mr Jones has itchy spots.	✓	
Mr Jones has a high temperature.	✓	
Mr Jones will get better if he goes to bed.		✓

Lesson 4 Big rocks from little rocks

Pages 23 and 24

Mastery test 2 – Igneous or sedimentary?

1. The arrows match the boxes on the left with their correct meanings.



2. (a) Would you class the rock in the photograph on page 24 as an igneous rock or a sedimentary rock?

This is a sedimentary rock.

(b) Give a reason for your answer.

This rock is made of particles which have been cemented together whereas igneous rocks are made of crystals that fit into each other.

3. (a) A student named Chris is studying another rock specimen. His observations (O) and inferences (I) are listed below.

O	This rock contains large crystals that are joined together.
O	This rock is pinky-grey in colour.
I	This rock was formed by the cooling of molten material.
O	This rock contains several different minerals.
I	This rock cooled deep underground.

(b) Is this an igneous rock or a sedimentary rock?

This is an igneous rock.

(c) Give a reason for your answer.

The rock is made of crystals joined together so it is igneous.
Sedimentary rocks are made of particles compressed and cemented together.

Lessons 5 and 6

Fossils

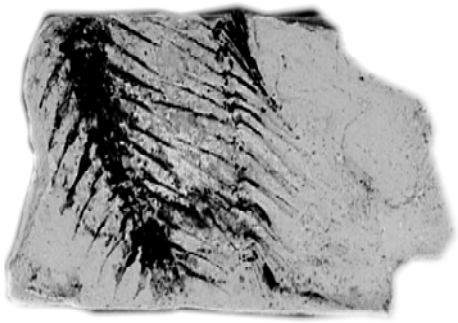
Pages 33 and 34

Mastery test 3 – Making fossils

1. Some sedimentary rocks contain fossils. What are fossils?
   Fossils are the remains or traces of living things that have been preserved in rocks.

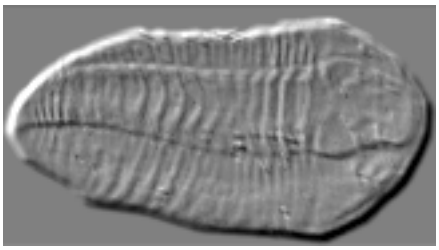
2. (a) Can you name the animals that produced these fossils?

Rock A



fish

Rock B



trilobite

   (b) Which of these rocks is probably older? *Rock B*
   Give a reason for your answer.
   Trilobites are found in old rocks but fossil fish are found in younger rocks.

3. (a) Is the animal in the diagram on page 33 living on the Earth's surface today? *no*
   (b) This animal is said to be extinct. What does this mean?
   The animal was once living but has since died out.

4. (a) Look at this fossil fish on page 33. Which parts of the animal have been preserved in the rock? *The bones and fins have been preserved.*
   (b) Are these parts hard or soft? *They are hard parts.*

5. The conditions with ticks would be needed for a living thing to form a fossil.

Conditions needed for forming a fossil

- [✓] Layers of sediment are being laid down quickly.
- [✓] The organism is protected from being eaten or rotting.
- [ ] The organism is in water.
- [✓] The sediment layers must not be disturbed until they become rock.
- [✓] The sediment becomes cemented together.
- [ ] The organism lives near a volcano.

Lessons 5 and 6 continued

Page 34 6. Use your answers in Question 4 and the statements you ticked in Question 5 to write a description of the conditions under which fossils form.

Here is an example of a correct answer.

Fossils form when organisms with hard body parts settle and are covered with layers of sediment. If the organism is protected from being damaged and the sediment is not disturbed for a long time, the sediment can become cemented together and a fossil forms inside the rock.

Pages 35 and 36

Mastery test 4 – Making fossils

1. Before you believe a statement, you should always look for *evidence* to support the claim.

2. Scientists can deduce what the Earth was like millions of years ago by looking at *rocks* now on the Earth's surface.

3. If you look at rocks you can **observe**:
   - what the rock is made of
     For example, *igneous* rocks are made of joined crystals.
     Sedimentary rocks contain *particles or sediments* cemented together.
   - if the rock contains fossils.
     Fossils are only found in *sedimentary* rocks.

4. You may be able to use information from observations to **infer**:
   - how the rock formed
     For example, small crystals in igneous rocks indicate that the rock cooled *quickly* and probably formed in a *lava flow*.
   - the types of plants and animals that lived in the area when the rock was being formed
   - how long ago the rock was formed
   - the environment at the time that the sediment was laid down.
     For example, if you find a fossil *fish* in a high mountainous area, then you can infer that this land was once under the *sea or ocean*.
     Tillite indicates that the climate was very *cold* at the time that the sediment was laid down.
     Coal forms from plants which usually grow in a warm, wet climate.