Geological Timeline

This activity uses the visual concept of length to simulate geological time. Students are given an event that helped shape Gippsland to place along the time line. Students will notice that geology is a continuous event, not something that just occurred in the past.

Materials

- *Stratigraphy of Gippsland*, page 33
- *Geological Time Event Cards*, page 40
- 2 m (2,000 mm) of cash register tape
- Calculators
- Pens
- Measuring tape

Learning methodology

1. Mark the cash register tape at intervals of 35 mm. Each interval represents 10 million years, ending at 570 million years (2,000 mm/570 = 35 mm = 10 million year intervals).
2. Using the Stratigraphy of Gippsland, mark the duration of each Period and Epoch on the tape, starting with the Cambrian.
3. Provide each student with a Geological Time Event Cards to place on the geological timeline created in step one. Students should read out to the class what geological events occurred at this time.

Questions

1. Discuss what was happening to the earth when there are large gaps along the tape; was this a slow event that was taking time?
2. Discuss the timing of key events in relation to the formation of Gippsland's features.
3. Discuss the role of water and rivers in shaping our landscapes.

Extension activities

- ABC video series 'Our Earth'
- Significant events such as species extinctions could also be used

Geological Time Event Cards

Waratah Bay Greenstones
Cambrian
Igneous rocks that form the base of Gippsland. They came from sea based volcanoes

Snowy River Volcanics
Silurian
Volcanic Flows that flooded the area between the Snowy and Tambo Rivers

Buchan Limestone
Devonian
The remains of shellfish and coral are deposited in a shallow marine basin and begin to form limestone

Benambran Orogeny
Late Ordovician
Mountain building process causing the uplift of the sea bed to dry land causing metamorphism of rocks

Wonthaggi Black Coal
Cretaceous
Plant materials accumulated in swamps to later form a sedimentary rock black coal

Thorpdale Basalts
Tertiary
Volcanic flows cover sediments in the Gippsland Basin before this area is uplifted into the Strzelecki Ranges

Wilson's Promontory Granite
Middle Devonian
Magma from below the Earth's surface penetrates bedrock and cools into granite. Later erosion of the bedrock leaves granite boulders

Haunted Hill Gravels
Early Quaternary
Fast flowing rivers bring eroded gravels and sands from the uplifting Eastern Highlands and deposit them on a large plain

Eastern Highlands
Late Ordovician
Sandstones and slates that were deposited into an ancient sea are metamorphosed

Ignimbrites
Late Devonian
Explosive lavas are ejected onto the surface often leaving craters up to 40 km wide

Glaciers
Permian
Gippsland was located close to the South Pole and was covered with glaciers at this time

Gippsland Basin
Cretaceous
The separation of Australia and Antarctica leaves a large depression. Rivers from both continents deposit sediments here

Continental Drift
Early Cretaceous
Antarctica and Australia are separated by a narrow seaway

Browning Orogeny
Silurian
Granite is intruded into bedrock during this period of mountain building

Taberabberan Orogeny
Devonian
Granite is intruded into bedrock during this period of mountain building

Mitchell River Silt Jetties
Holocene
Sediments carried by the Mitchell River no longer make it to the sea. They accumulate to build a delta at the river mouth

Earthquakes
Holocene
Minor earth tremors occur along fault lines such as the Haunted Hills Fault

Moe Swamp
Holocene
Subsidence in this area leads to deposition of sediments

90 Mile Beach
Recent
Falling sea levels allow beach sand to be blown inland forming the sand barrier enclosing the Gippsland lakes

Marine Regression
Holocene
As climate stabilizes sea levels fall to present day levels

Marine Transgression
Holocene
Melting glaciers in the Northern Hemisphere causes sea levels to rise, building sea cliffs now enclosed by the Gippsland Lakes

How Caves are Made

Limestone was laid down by layers of marine life when an inland sea covered East Gippsland's Buchan over 300 million years ago. Caves formed when water containing dissolved carbon dioxide from the soil and atmosphere seeped from the surface into cracks in the limestone. This slightly acidic water joined with groundwater to dissolve the rock, forming cavities which enlarged to make systems of connected chambers. When the level of groundwater lowered it left behind air filled chambers where cave decorations such as stalactites eventually formed.

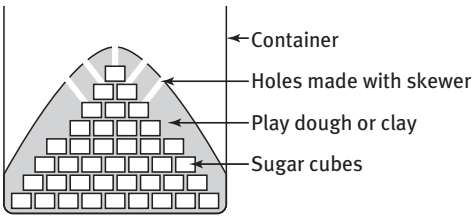
This activity demonstrates how caves are created in limestone via the process of acidic surface water seeping through the soil.

Materials

- 2 packets sugar cubes (representing limestone)
- Glass or plastic container
- Green food colouring and warm water in container
- Plastic pipettes or eye droppers
- Play dough or modelling clay
- Skewer

Learning methodology

1. The container provides a cross section view. You could use a square sided jar, fish tank or square sided juice bottle cut in half.
2. The sugar cubes should be made into a pyramid against the side of the container (see diagram).
3. The play dough represents the soil surrounding the limestone.This should be moulded over the sugar cubes in a 1cm layer. Make sure it is pressed up against the container wall all around the pyramid.



4. Using the skewer make 4–5 holes (more if you are using a large container) in the top of the clay layer. The holes should expose the sugar cubes below. These represent cracks in the surface layer.
5. Pipette warm water and food dye through the holes in the surface layer. This represents acidic surface water making its way from the surface through the soil and cracks in the limestone.
6. The warm water will dissolve the sugar cubes (it will be faster, the warmer the water is) leaving a 'cave' behind.

Questions

1. How has the water changed as it has passed through the mountain?
2. How long does it actually take for caves to form? Are they forming now?
3. Where does the groundwater go when it leaves the cave chamber?
4. What would East Gippsland be like now if the inland sea that deposited the limestone remained?

Extension activities

- Contact Parks Victoria to plan a visit to the Buchan Caves
- Geological timeline activity
- ABC video series 'Our Earth'

Rock Detective

This activity allows students to use simple clues to classify rocks into the three rock types, metamorphic, igneous and sedimentary. It is a useful activity to use after a Waterwatch or field ecology activity to build students investigatory and research skills. Students or teachers can collect these rocks, or prepared specimen kits can be used. Alternatively, rocks could be collected in riverbeds or along the coastline as part of a catchment visit. Before collecting rocks, please check with appropriate authorities to find out if collection is permitted.

Materials

- *Rock Detective Worksheet*, page 43
- One each of sedimentary, metamorphic and igneous rocks per group (a labeled number can be placed on the rock for teacher identification).
- Rock and mineral identification book
- Palette knives
- Hand lenses or magnifying glasses

Learning methodology

1. Each group of students has access to a set of three rocks, magnifying glass and palette knife.
2. Each group works through the clues and writes the chosen rock type on the worksheet for each rock.
3. Students come together and compare results.

Questions

1. Which clues helped you solve the mystery for each rock type?
2. What clues were hard to investigate? Why?
3. Swap rocks with another pair of detectives in your classroom. Follow the steps again and compare results.
4. If students had different answers, which rocks were difficult to classify?
5. What might the different rocks be used for? Which properties make them suitable for these purposes?

Extension activities

- Undertake this activity as part of the Biodiversity Study Field Trip page 59
- Undertake this activity as part of the ABC video series ‘Our Earth’

Rock Detective Worksheet

As a Rock Detective, use the clues to solve the mystery of what rock types your samples belong to.

What we already know!

1. Rocks are the most common naturally occurring material on earth.
2. They are made up of one or more minerals such as quartz or even gold!
3. Rocks can be divided into three types depending on how they were formed:
   - Igneous
   - Sedimentary
   - Metamorphic

The rock types

Igneous rocks
All rocks formed from molten magma beneath and upon the Earth's surface.
Metamorphic rocks
Other rock types changed by heat or pressure.
Sedimentary rocks
Rocks made when sediments like sand, mud or even plants and animals are compressed and cemented together over time.

Clue list 1

	Rock 1		Rock 2		Rock 3	
	Yes	No	Yes	No	Yes	No
Can you see interlocking grains with a magnifying glass?	☐	☐	☐	☐	☐	☐
Is it dark coloured?	☐	☐	☐	☐	☐	☐
Is it heavy compared to other rocks?	☐	☐	☐	☐	☐	☐
Can you see air bubbles in it?	☐	☐	☐	☐	☐	☐

If you answered 'yes' to most of these questions, it is probably an igneous rock, but keep checking!

Clue list 2

	Rock 1		Rock 2		Rock 3	
	Yes	No	Yes	No	Yes	No
Are there individual grains cemented together?	☐	☐	☐	☐	☐	☐
Can you see any fossils?	☐	☐	☐	☐	☐	☐
Is it lighter than other rocks the same size and pale in colour?	☐	☐	☐	☐	☐	☐
Can you scratch it with a knife?	☐	☐	☐	☐	☐	☐

If you answered 'yes' to most of these questions, it is probably a sedimentary rock, but keep checking!

Clue list 3

	Rock 1		Rock 2		Rock 3	
	Yes	No	Yes	No	Yes	No
When you tap it does it make a 'ching' sound rather than a 'chung'?	☐	☐	☐	☐	☐	☐
Can you see interlocking grains with a magnifying glass?	☐	☐	☐	☐	☐	☐
Do the grains look like they all point in the same direction?	☐	☐	☐	☐	☐	☐
Does the rock have bands of light and dark colours?	☐	☐	☐	☐	☐	☐

If you answered 'yes' to most of these questions, it is probably a metamorphic rock, however...

Using a rock and mineral identification reference book, see if you have successfully identified your rock.

Erosion on Bare Soil

This activity utilises basic experimentation to compare the effects of rainfall on bare and vegetated soil. The activity needs to be planned well in advance due to the need to germinate grass seed.

Materials

- *Erosion on Bare Soil Worksheet*, page 45
- 2 x 2 litre milk cartons
- Soil (a clay loam is best, sand should be avoided)
- 1/8 cup of quick sprouting grass seed or wheat grass seed
- Cling wrap
- Sticky tape or masking tape
- Permanent marker
- 2 clear plastic 1.25 litre soft drink bottles (caps not required)
- 1 litre measuring jug
- Nylon fly screen
- 2 coffee filters
- Watering can

Questions

1. Why is it important to tilt the trays? What does this represent?
2. Which tray had the most runoff? Why?
3. How much soil washed off the trays?
4. Why do we need to maintain vegetation cover on our landscapes?
5. How does erosion impact on our waterways?

Extension Activities

- Before undertaking this activity, pour water from a watering can on an eroded part of the school ground. Compare this with a vegetated part. Discuss with students what activities in a catchment result in exposed soil
- Research topsoil loss in books, the Internet or newspapers (such as The Age on CD). Can you find any local examples?

Erosion on Bare Soil Worksheet

Learning methodology

1. Remove one side of each of the milk cartons so that the spout forms a "v" on the top side (see Diagram 1).
2. Label one of the cartons 'Vegetated Soil' and the other 'Bare Soil'.
3. Bare soil carton:
   a. Fill with soil and pack down well so that it comes to 5mm from the top.
   b. Water evenly.
4. Vegetated soil carton:
   a. Fill with soil and compress lightly until it comes to 5 mm from the top.
   b. Sprinkle grass seed evenly over the container and cover lightly with more soil.
   c. Water evenly.
   d. Cover the carton with cling wrap, leaving the corners open for ventilation.
   e. Leave the carton in a warm, sunlit position – but not in direct sunlight, which will cause it to overheat and dry out too fast.
   f. Keep the soil moist, but not saturated until the grass sprouts – about a week.
   g. When the grass reaches ~5mm remove the cling wrap and allow the soil to dry out a little bit for a few days
5. For each of the soft drink bottles, cut the top off and invert it to make a funnel. Sit it inside the bottom part. Cut a piece of fly screen to fit inside the funnel, then wet a coffee filter and place it inside the funnel also (see Diagram 2). These filters will trap any soil run off whilst still allowing water through. Label one of the bottles 'Vegetated Soil' and the other 'Bare Soil'.
6. Measure 750 ml of water in the measuring jug or beaker.
7. Tilt the cartons at an approximately 15 degree angle. Have the bottles ready to catch the run-off.
8. Using the watering can, simulate rain on the soil cartons, one at a time. It is very important that you tilt the carton so that all of the water 'run-off' is caught in a filter bottle. Make sure you use the bottle with the same label as the carton.
9. Compare your results with other groups.

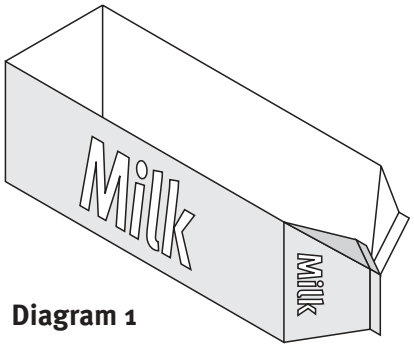


Diagram 1

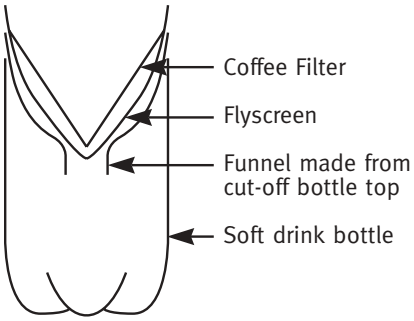


Diagram 2

Word Find

Circle each letter of the words from the word list below. Don't forget to cross words off as you find them!
Remember, words may be found horizontally, vertically, diagonally or even backwards!

To answer the question below, start in the top left corner of the grid.
Working left to right, and top to bottom, list all uncircled letters in the space below.

As you find each word, define its meaning on a separate sheet.

F	E	R	T	I	L	I	Z	E	R	S	E	T	E	Y	E
U	E	P	A	C	S	D	N	A	L	R	R	R	T	T	P
E	N	O	T	S	E	M	I	L	O	E	A	I	I	W	H
G	S	L	E	N	N	U	T	S	E	C	N	N	T	I	O
A	N	L	I	O	S	F	I	P	D	I	A	L	S	N	S
L	I	I	N	A	E	O	L	N	L	R	B	I	T	D	P
A	L	E	G	N	N	A	A	A	G	L	A	M	S	F	H
R	N	D	C	G	N	L	S	G	T	Y	P	E	A	A	O
U	R	I	A	T	O	N	D	F	E	N	E	C	O	R	R
R	N	T	I	I	C	L	I	I	A	O	A	L	C	M	U
G	E	N	I	S	B	T	R	T	E	R	L	N	L	S	S
H	G	E	F	A	U	T	U	E	R	B	M	O	M	U	R
E	D	I	S	K	C	O	T	S	T	O	A	I	G	E	G
R	E	A	C	E	R	U	N	A	M	A	G	C	N	Y	R
T	L	S	E	D	I	M	E	N	T	S	W	E	K	G	I
T	S	T	L	E	B	R	E	T	L	E	H	S	N	O	N

BASALT
COASTS
DIEBACK
EROSION
FARMING
FENCING
FERTILIZER
GEOLOGY
GRANITE
GULLEY
LANDCARE
LANDSCAPE
LIME
LIMESTONE
MANURE
NITROGEN
PHOSPHORUS
REMNANT
RURAL
SALINITY
SEDIMENTS
SHELTERBELTS
SOIL
STOCK
TREEPLANTING
TUNNEL
WATERLOGGING
WINDFARMS

Question: How can we maintain our livelihood and landscapes in Gippsland?

Answer: Sustainable land practice is the future direction