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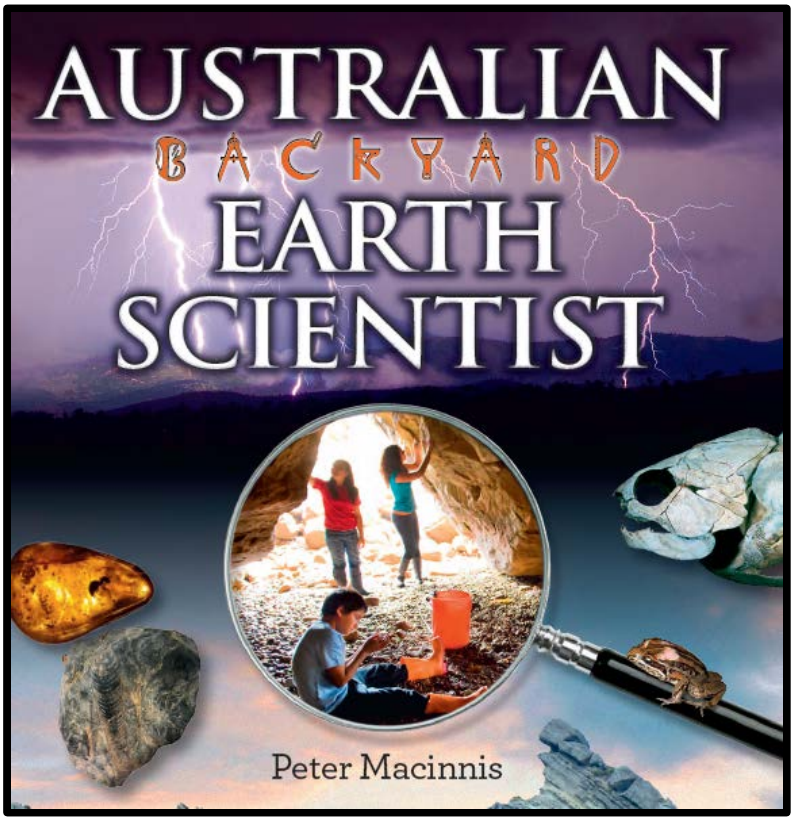
TEACHERS' NOTES

Australian Backyard Earth Scientist
by Peter Macinnis



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Recommended Year Levels: 4 to 8

Author: Peter Macinnis

Peter Macinnis is a Sydney-based science and history writer. His many awards include the 2010 Children's Book Council of Australia Eve Pownall Winner for *Australian Backyard Explorer*, and the 2012 Whitley Award, Young Naturalist category, from the Royal Zoological Society of NSW and the 2013 WA Premier's Book Awards, Children's Literature (joint winner) for *Australian Backyard Naturalist*. For *The Big Book of Australian History*, Peter

received a Notable Book award in the 2014 Children's Book Council of Australia Book of the Year Awards.

About the Book

Find out where rain comes from and what geysers look like! Read about soil becoming too salty and why greenhouse gases are increasing. Did you know that fog is a cloud sitting on the ground and that ice can tell you about the environment of millions of years ago? And what is lightning anyway?

Australian Backyard Earth Scientist is full of fantastic photos and fascinating information that help explain different aspects of earth science—a science that discovered how old the Earth is, what fossils tell us, how mountains were created, what causes earthquakes, what the difference between weather and climate is, and why glaciers are melting. These questions and many more are answered in *Australian Backyard Earth Scientist*. There are projects, as well, that you can do at home—like making your own fossils, collecting cloud types, and using tree rings to find out about past weather.

AUSTRALIAN CURRICULUM CONTENT

- Learning Area(s)
    - Science

- General Capabilities
    - Personal and Social Capability
    - Critical and Creative Thinking
    - Information and Communication Technology Capability
    - Numeracy

- Cross Curriculum Priorities
    - Sustainability

INTRODUCTORY ACTIVITIES

These are activities to do before reading to prepare students for the concepts/themes explored in the book. They are not necessarily curriculum based.

How Humans Use Rock and Stone

This activity shows us why rocks matter.

Left to right: a fossil-rich wall, Agrigento, Sicily; a limestone dolmen, The Burren, Ireland; decoration, Angkor Wat, Cambodia

Left to right: a Roman bridge, northern Spain; hieroglyphs, Valley of the Kings, Egypt; Inca wall, Cusco, Peru

Rock painting, Mitchell Plateau, Western Australia; engraved shark, Sydney, New South Wales; hand stencil, Mulka's Cave, Western Australia

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

Stimulus material similar to above.

The Task

Compile a list of unusual ways humans in many cultures have used rock and stone.

Extension Activities

What are the world's biggest constructions? What is the single biggest rock used anywhere? What is the oldest stone structure still standing?

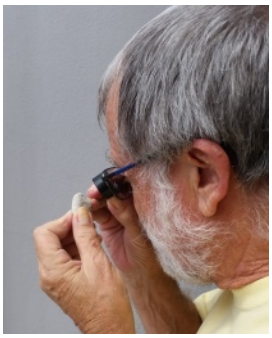
Looking at Rocks under a Lens

This activity refers to material on page 55.

Equipment

You will need:

- a hand lens, or a clip-on microscope (for example, a Go Micro, which fits on smartphones and tablets—see the Resources list at the end of these notes)
- small (smaller than fist sized) specimens of some rocks, with fresh surfaces. Try a local stone yard or mason. A good starter set would include:
    - limestone
    - sandstone
    - shale
    - basalt
    - granite
    - marble.



The Task

Look at some rock samples and agree on how they differ.

If using a hand lens, make sure it is held close to the eye. Bring the object in and out to bring it into focus (see image on right).

Caution!

If students are collecting samples, they need to know to stay off private property and nature reserves, and should be familiar with the caveats listed on page 74 of *Australian Backyard Earth Scientist*.

Ask students to prepare their own list of dos and don’ts.

Floating Pumice

This activity refers to material on pages 60 and 61.

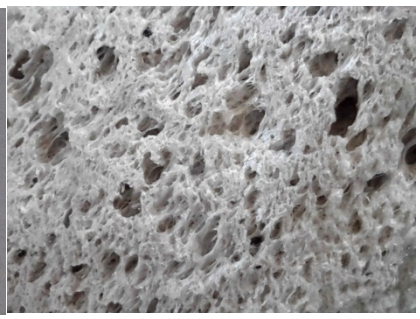
Equipment

You will need:

- a bowl of water
- some pieces of pumice (sold at most pharmacies; can also be found near most ocean beaches on Australia’s east coast).

The Task

Handle the pumice and feel how light it is, before putting it in the water. Estimate how much of a piece of floating pumice is submerged. What makes this peculiar rock float in water? (Hint: the answer lies in the bubbles.)

A look under the hand lens makes it clear why the rock floats.

Caution!

Students shouldn't rub pieces of pumice together; the dust is bad for lungs and small children.

AUSTRALIAN CURRICULUM CONTENT: SCIENCE

Year Level: 4–8

Australian Backyard Earth Scientist addresses most of the Science Curriculum outlined in the Australian Curriculum for years 4–8.

Content featured in this book covers:

- Science Understanding
  - Chemical Sciences
  - Earth and Space Sciences
  - Physical Sciences*

- Science as a Human Endeavour
  - Nature and Development of Science
  - Use and Influence of Science

- Science Inquiry Skills
  - Questioning and Predicting
  - Planning and Conducting
  - Processing and Analysing Data and Information
  - Evaluating
  - Communicating

*not present in Year 5

Suggested activities for each year level are outlined below.

Further information about the Science curriculum can be found at www.australiancurriculum.edu.au/f-10-curriculum/science/

YEAR LEVEL: 4

Science Understanding

Chemical Sciences

Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)

Earth and Space Sciences

Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)

Physical Sciences

Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076)

Activities

Identifying Local Weathered Rock

This activity refers to material on or about pages 88 to 97. It also appears in these notes as a Year 8 HASS—Geography activity, but can be dealt with here in a gentle way.

Start with Banjo Paterson's poem, *Been There Before* (see the Resources list at the end of these notes). Discuss the lack of stones or rocks in some places.

Equipment

You will need:

- access to weathered rock faces and rock surfaces in your local environment, for example:
  - naturally occurring rock faces
  - road cuttings*
  - old stone buildings
  - tombstones.

The Task

Find a variety of weathered surfaces in your area. Take photos or make drawings.

Discuss:

- where are the nearest examples of weathering?
- what caused the weathering?

Caution!

Students should take care when making observations near roads.

Two examples of spectacular weathering. Uluru, Northern Territory (left); Dinner Table Rocks, near Berry, New South Wales (right)

Comparing Sugar and Salt Crystals

This activity refers to material on pages 55 to 57.

Equipment

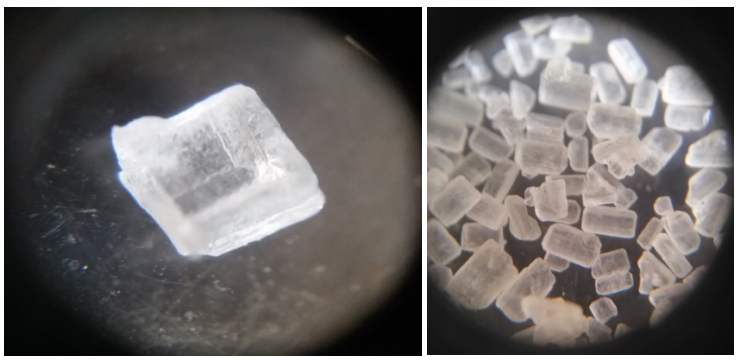
You will need:

- salt of different sorts:
  - table salt
  - sea salt
  - cooking salt
- sugar of different kinds: white sugar, brown sugar, raw sugar, caster sugar etc.
- hand lens, clip-on or microscope.

The Task

Using the hand lens, clip-on or microscope, compare salt with sugar, and compare different kinds of sugar with each other.

Observe how crystals form when identical units pack together.



Rock salt (left) and sugar crystals (right). These two images were taken with a clip-on microscope.

The circular view shows a field about 9 millimetres across.

Making Mud Cracks

This activity refers to material on page 107.

Equipment

You will need:

- suitable mud—either already cracked (so you know it will work) or wet and really sticky
- plastic bags
- water
- a flat dish
- 50-cent coin
- camera.


Dried mud, Bondi, New South Wales (left); Australian tourists caught in sticky mud, Moroccan desert (right)

The Task

Collect some dried mud in the plastic bag and tie it off. Put that in a second plastic bag, tie it off and take it home.

Find somewhere safe, like a garden shed. Mix the mud with water. Stir the mud well, and leave it to dry in a flat dish.

Take photos twice a day, if you can, including the 50-cent coin for scale. How soon did the cracking start?

Taking a Close Look at Sand

This activity refers to material on pages 69 and 70. It also appears in these notes as a Year 6 activity.

Equipment

You will need:

- small amounts of sand from:
    - bush tracks
    - beaches
    - erosion washouts

- school sandpits
- hand lens, clip-on or microscope (preferably something which can take pictures)
- black or blue cardboard.

You will only need a small pinch of sand

The Task

Examine the different sand samples using the hand lens, clip-on or microscope. Take pictures if possible, with the sand on black or blue cardboard.

Generate hypotheses that might explain the differences between them. Decide how these hypotheses might be tested.

A clip-on gives adequate study prints. Make sure you label the images.

Science as a Human Endeavour

Nature and Development of Science

Science involves making predictions and describing patterns and relationships (ACSHE061)

Use and Influence of Science

Science knowledge helps people to understand the effect of their actions (ACSHE062)

Activities

Erosion near Here

This activity refers to material on pages 108 to 117.

Equipment

None.

The Task

Identify local areas where erosion is happening.

Extension Activity

Work out some ways to stop the erosion—for example, using logs or rocks to slow the water flow.

Natural Water near Us

This activity refers to material on pages 127 to 145.

Water seeping out of dunes on Soldiers Beach, near The Entrance, New South Wales (left and centre); a rock pool near Sydney (right)

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

None.

The Task

Describe a scenario for your students in which the usual water supply has failed—for example, damage to the water main which will take six weeks to fix.

Discuss: where could you go (nearby) to get water?

Extension Activity

Discuss: what would you need to do before drinking that water? Why?

For teachers: look for answers including but not limited to: contamination from dead animals, bacteria, viruses, amoebae, worm eggs, algal blooms, mud and clay solids, dissolved chemicals, salt, run-off from farms.

Moon Diary

This activity relates to material on page 172. It also appears in these notes as a Year 7 activity.

Equipment

You will need:

- a camera

- a notebook.

The Task

Assemble a record of the lunar cycle over a whole month. Your record could include notes, photographs and drawings.

You should include:

- the moon's phase
- the time it was observed
- an estimate of the time at which it rose, by estimating that each 15° above the eastern horizon means an hour since moonrise. (Practise using a clenched fist as about 15°, and pile them on top of each other.)

Discuss what to do with missing data from cloudy nights.

You may wish to could repeat this task over a couple of months.

Science Inquiry Skills

Questioning and Predicting

With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (ACSIS064)

Planning and Conducting

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS065)

Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS066)

Processing and analysing data and information

Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS068)

Compare results with predictions, suggesting possible reasons for findings (ACSIS216)

Evaluating

Reflect on investigations, including whether a test was fair or not (ACSIS069)

Communicating

Represent and communicate observations, ideas and findings using formal and informal representations (ACSIS071)

Activities

Observing Transpiration

This activity refers to material on page 125.

Equipment

You will need:

- a suitable bush
- a clear plastic bag
- sticky tape.

The Task

Follow the instructions in the project on page 125.

Extension Activities

Use a sensitive balance to weigh the bag (and tape) before and after. Make an estimate of how much water the whole plant transpired. Write a report listing the possible sources of error in the estimate.

Meteor Watch

This activity refers to material on pages 204–205.

Equipment

You will need:

- meteor shower data, suitable for Australia (see Resources list at the end of these notes).

There are seven main showers each year; knowing about these can make the act of looking for ‘shooting stars’ more rewarding. If you are a city school, and can get the timing right, this could be a school camp activity.

The Task

Banning the use of torches, devices with lights and any other distractions, have the students count all the meteors they see in five minutes.

Extension Activity

Repeat the count several times during the night.

Note: a meteoroid is a space rock; a meteor is a space rock ‘burning up’ in the atmosphere; and a meteorite is any piece of space rock that reached the surface in one piece.

YEAR LEVEL: 5

Science Understanding

Chemical Sciences

Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)

Earth and Space Sciences

The Earth is part of a system of planets orbiting around a star (the sun) (ACSSU078)

Activities

Planet Watch

Equipment

You will need:

- an accurate timekeeper (for example, a clock or watch)
- binoculars.

The Task

Track one or more planets over several weeks. Record the times of:

- rising
- setting, or
- reaching a certain point in the sky.

Tip: to ensure your head is always in the same place when observing and recording, place your chin on a table, or your head against a tree, and use a false horizon, such as the roof of the house next door.

Extension Activities

Try using the clinometer (see page 10) to take sightings on the planet of choice. (It won't be easy!)

Caution!

Students should let their neighbours know what they are doing, especially if they are out in the yard at night with binoculars.

Floating Ice

This activity refers to material on page 128.


Calved-off glacial ice, Glacier Bay, Alaska (left); glacial ice with seagulls (right)

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

You will need:

- ice cubes from the freezer
- a bowl of water.

The Task

Before showing students the pictures, ask:

- why is it important for wildlife that ice floats? Hint: polar bears and walruses!

Extension Activities

Why is it important for fish that ice floats?

(This is a tricky one! Ask students to think about it overnight. If they are still stumped the next day, explain that if ice sank, it would fall to the bottom and the seas would get shallower. As it is, ice stays up near the surface and melts in the sun.)

Make an ice lens (see Resources list at the end of these notes).

Listing Season Markers

This activity refers to material around pages 168 to 170.

Equipment

None.

The Task

Read the essay on page 170 to students.

Ask:

- what are *your* season markers, here, where we live?

Ask students to run their ideas past their family. Then ask them to write their own version of the essay on page 170, in their own words.

Extension Activity

Make a case for changing the Australian calendar to have six seasons. Specify starts and finishes.

Science as a Human Endeavour

Nature and Development of Science

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081)

Use and Influence of Science

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083)

Activities

Tide Watch

This activity refers to material around pages 177 to 183.

King high tide, Sydney, January 2018, breaching the first lines of defence

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

You will need:

- access to a beach
- an accurate watch
- a tide chart for your area (available online)
- a stick, about 50 centimetres long
- sun protection.

The Task

Every port has a place where tidal data are taken—but, upstream and downstream, the high tide can be earlier or later.

Get to the beach half an hour before 'official' high tide.

Mark the highest point the next wave reaches with the stick, poking it at least 30 centimetres into the sand. Note the time.

Repeat this each time a higher wave comes in.

When no higher wave has come in for 15 minutes, the last recorded time is your local high tide time

Tip: don't be tricked by boat wash!

Extension Activities

Repeat the exercise on low tide times, marking the furthest withdrawal of the water in a similar way.

Alternatively, test a series of beaches upstream and downstream to see if there is a pattern.

Cloud Watch

This activity refers to material around pages 152 and 153.

Equipment

You will need:

- internet access
- cameras
- notebooks.

The Task

Have the class, working individually or in small groups, come up with a list of cloud types. (If students need help, direct them to the Bureau of Meteorology's information about clouds).

Over the next fortnight, ask students to observe and take photos of as many different cloud types as possible.

Extension Activity

Research and find pictures of lenticular cloud.

Science Understanding

Questioning and Predicting

With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231)

Planning and Conducting

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086)

Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS087)

Processing and Analysing Data and Information

Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090)

Compare data with predictions and use as evidence in developing explanations (ACSIS218)

Evaluating

Reflect on and suggest improvements to scientific investigations (ACSIS091)

Communicating

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS093)

Activities

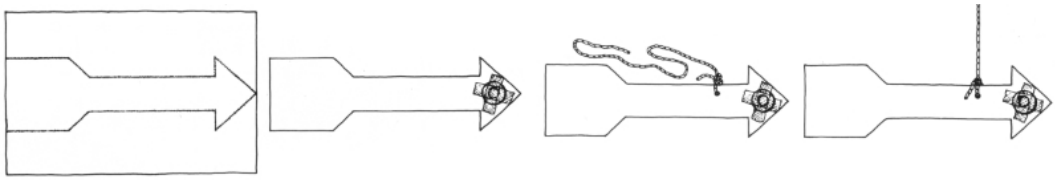
Making a Windvane

This activity refers to material around pages 164 and 165. It also appears in these notes as a Year 6 activity.

Equipment

You will need:

- manila cardboard
- ruler
- pen
- scissors
- sticky tape
- a metal washer
- a sharp point to make a hole
- diagram showing how to make a portable windvane (below).



How to make a portable windvane

The Task

From the manila cardboard, cut out the shape as shown in the diagram.

Tape a washer near the point of the arrow.

Experiment to find the balance point. Make a hole there, tie on a string and dangle it.

Ask students:

- how could you improve on this design?

Extension Activity

Work out why the windvane works.

(The balance point where the string goes in has more cardboard behind it than in front.)

Wave Frequency

This activity refers to material around pages 184 and 185.

Equipment

You will need:

- access to a beach with gentle surf
- a notebook
- a pen
- a digital clock (with seconds)
- two seats
- sun protection.

The Task

In pairs, observe the regularity of the waves, recording the times of a series of 30 or 40 waves.

To do this reliably, students will need to decide on a particular point in the cycle to observe—for example, 'when the wave crashes' or 'when the wave gets to its highest point on the beach'.

Starting a new page in their notebook, students should record the:

- date

- time
- location
- any other helpful details (e.g. the direction of the waves, whether the waves are ‘dumping’, etc.)

One student in each pair should be the scribe; the other student should be the observer.

Suppose you are using ‘highest point’, and you start at 10.14 am. The scribe writes down 10:14 and watches the clock.

The other student says ‘Now!’ at the right moment. The scribe sees that the seconds count is 12, and completes the record, which now reads 10:14:12.

There will be another wave along before the minute is up, so the scribe writes ‘10:14’ on the next line. (Close to the minute turnover, the scribe should write just ‘10:’.)

Take your data home, and look for patterns. You could use a computer to produce a visual display that will make any patterns stand out.

Extension Activity

Run tests at different times and in different conditions, such as:

- at different parts of the tide cycle
- on stormy days and calm days
- with onshore and offshore breezes blowing.

Caution!

Students should ensure they have adequate sun protection. Take care around waves.

YEAR LEVEL: 6

Science Understanding

Chemical sciences

Changes to materials can be reversible or irreversible (ACSSU095)

Earth and space sciences

Sudden geological changes and extreme weather events can affect Earth's surface (ACSSU096)

Physical Sciences

Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097)

Activities

Australian Earthquakes

This activity refers to material on page 28.

Equipment

You will need:

- internet access.

The Task

Come up with a list of Australia's ten biggest earthquakes.

Map their locations and magnitudes. Now look at the map and see if you can predict *where* the next 'serious' earthquake will happen. (You will need to come up with a definition of 'serious'.)

Draw up a timeline of these earthquakes. See if you can use the timeline to predict *when* the next 'serious' earthquake will happen?

How reliable would these predictions be? How could you make them more reliable?

(The list should include Meckering, Newcastle, Adelaide, Meeberrie and Cadoux.)

Extension Activity

Can you do it without looking at Wikipedia?

Australian Tsunamis

This activity refers to material around pages 29 to 31.

Equipment

You will need:

- internet access.

The Task

Come up with a list of Australia's ten biggest tsunamis and their heights.

(The Bureau of Meteorology's Past Tsunami Events provides a master list.)

Extension Activity

Rank the tsunamis by their strength.

Lightning and Thunder Counts

This activity refers to material around pages 166 to 168.

Equipment

None.

The Task

Follow the instructions in the last paragraph on page 167.

Extension Activity

Find a better way to do the timing.

Caution!

Stay indoors when there is lightning around.

A Table of Ice Ages

This activity refers to material on page 201.

Equipment

You will need:

- internet access
- reference books.

The Task

Produce a table of the known Ice Ages for the past several million years.

Extension Activity

Report, for each one, what the effects were in Australia. The answers are surprising, though we have had a few glaciers.

Science as a Human Endeavour

Nature and Development of Science

Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE098)

Use and Influence of Science

Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE100)

Activities

Australian Alternative Energy Sources

This activity refers to material around pages 50 and 51.

Equipment

You will need:

- internet access.

The Task

Come up with a list of the forms of renewable energy in use in Australia at the moment.

Do we use:

- geothermal
- solar
- wind
- tidal
- hydroelectric power?

Where? How close is it to us?

Extension Activity

Look up 'Thargomindah'. What is significant about it in terms of energy sources? Hint: the year 1898 was important in its history.

Where is the above potential (untapped) source of tidal energy to be found?

Answers may be found at the end of these notes.

Taking a Close Look at Sand

This activity refers to material around pages 69 and 70. It also appears in these notes as a Year 4 activity.

Equipment

You will need:

- small amounts of sand from:
    - bush tracks
    - beaches
    - erosion washouts
    - school sandpits
- hand lens, clip-on or microscope (preferably something which can take pictures)
- black or blue cardboard.

You will only need a small pinch of sand

The Task

Examine the different sand samples using the hand lens, clip-on or microscope. Take pictures if possible, with the sand on black or blue cardboard.

Generate hypotheses that might explain the differences between them. Decide how these hypotheses might be tested.

A clip-on gives adequate study prints. Make sure you label the images.

Science Inquiry Skills

Questioning and Predicting

With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS232)

Planning and Conducting

Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103)

Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS104)

Processing and Analysing Data and Information

Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS107)

Compare data with predictions and use as evidence in developing explanations (ACSIS221)

Evaluating

Reflect on and suggest improvements to scientific investigations (ACSIS108)

Communicating

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (ACSIS110)

Activities

Sun Watch

This activity refers to material on page 173.

Equipment

You will need:

- a digital camera
- a good view of a sunset horizon, with clear landmarks
- software to crop the images and get them on the same scale (optional).

The Task

Take a series of sunset photos.

Caution!

Let neighbours and other people in the area know what you are doing.

If you are using a digital viewfinder, it is safe to look at the late afternoon sun. *Do not look directly at the sun* using your eyes.

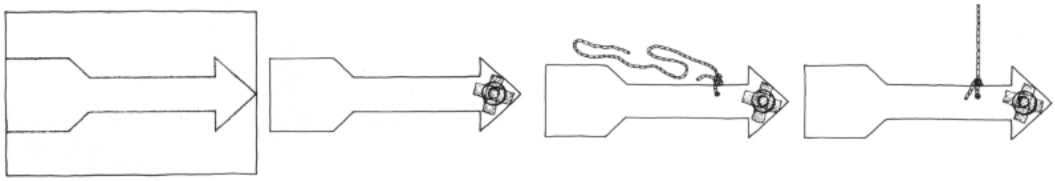
Making a Windvane

This activity refers to material around pages 164 and 165. It also appears in these notes as a Year 5 activity.

Equipment

You will need:

- manila cardboard
- ruler
- pen
- scissors
- sticky tape
- a metal washer
- a sharp point to make a hole
- diagram showing how to make a portable windvane (below).



How to make a portable windvane

The Task

From the manila cardboard, cut out the shape as shown in the diagram.

Tape a washer near the point of the arrow.

Experiment to find the balance point. Make a hole there, tie on a string and dangle it.

Ask students:

- how could you improve on this design?

Extension Activity

Work out why the windvane works.

(The balance point where the string goes in has more cardboard behind it than in front.)

YEAR LEVEL: 7

Science Understanding

Chemical Sciences

Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113)

Earth and Space Sciences

Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon (ACSSU115)

Some of Earth's resources are renewable, including water that cycles through the environment, but others are non-renewable (ACSSU116)

Physical Sciences

Change to an object's motion is caused by unbalanced forces, including Earth's gravitational attraction, acting on the object (ACSSU117)

Activities

A Sock Full of Granite

This activity refers to material to on page 61. It also appears in these notes as a Year 8 activity.

Equipment

You will need:

- a brick
- an old table
- a hammer
- a thick old sock
- a blanket or wads of newspaper
- a piece of granite (granite fragments can be found in granite country, but stone yards are also a good source)
- safety goggles
- a large cardboard box
- Petri dishes.

The Task

Lay the blanket or wads of newspaper on the table.

Place the brick onto the blanket or newspaper.

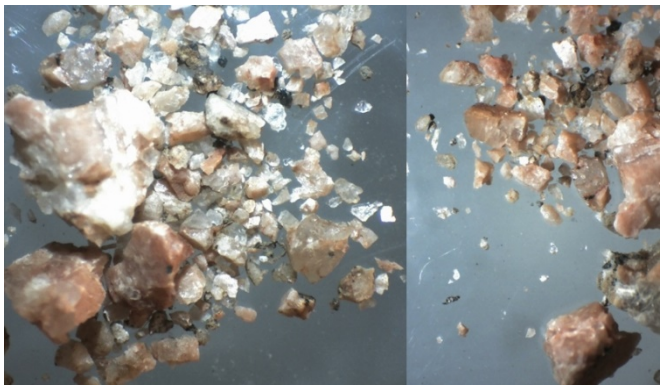
Put the granite in the sock and lay the sock on the brick.

Put on your safety goggles. Hit the sock with the hammer to smash the granite into fragments.

Divide the fragments into Petri dishes to share around the class.

Examine the fragments.

Note: many of the bits will be made up of crystals of a single kind, others will still be mixed.



Granite fragments

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Caution!

If the sock bursts, bits of granite may fly out—so unless *all* students have safety goggles, put the brick and sock down inside the cardboard box. Wear safety goggles yourself.

Extension Activity

How many kinds of crystal can you see in the fragments? How do you know they are different?

Moon Diary

This activity refers to material around pages 172. It also appears in these notes as a Year 4 activity.

Equipment

You will need:

- a camera
- a notebook.

The Task

Assemble a record of the lunar cycle over a whole month. Your record could include notes, photographs and drawings.

You should include:

- the moon's phase
- the time it was observed

- an estimate of the time at which it rose, by estimating that each 15° above the eastern horizon means an hour since moonrise. (Practise using a clenched fist as about 15°, and pile them on top of each other.)

Discuss what to do with missing data from cloudy nights.

You may wish to could repeat this task over a couple of months.

Making a Model of Rocks Folding

This activity refers to material around pages 32 and 33.

Equipment

You will need:

- different-coloured strips of sponge rubber (try scrounging offcuts from a local shop selling foam) or several different-coloured kitchen sponges
- glue or a stitching kit, suitable for the material you are using.

The Task

Join the different coloured strips of sponge in several layers, either with glue, or using thread pushed through many times and tied off.

Put your creation aside for a year.

Allow students to examine and handle the model. Discuss how rocks can deform when they are bent, heated and compressed.

Science as a Human Endeavour

Nature and Development of Science

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119)

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE223)

Use and Influence of Science

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE120)

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121)

Activities

Flat Earth to Plate Tectonics

This activity refers to material in *Australian Backyard Earth Scientist*, especially pages 4 to 9. It also appears in these notes as a Year 7 activity.

Equipment

You will need:

- a copy of *Australian Backyard Earth Scientist*
- internet access.

The Task

Read *Australian Backyard Earth Scientist* to find out how our knowledge of the planet changed. Create a timeline showing how our understanding of the Earth has changed.

Extension Activity

'Taking from one source is plagiarism, taking from many sources is research.' Get onto the web and search out the key terms, starting with the ones on pages 4 to 9 and building up. Now tell the story of how our understanding of the Earth changed *in your own words*.

Science Inquiry Skills

Questioning and Predicting

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124)

Planning and Conducting

Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125)

Measure and control variables, select equipment appropriate to the task and collect data with accuracy ACSIS126)

Processing and Analysing Data and Information

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129)

Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS130)

Evaluating

Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS132)

Communicating

Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS133)

Activities

A Model Seismometer

This activity refers to material on page 26.

Equipment

What equipment is needed will depend on how students tackle the task.

The Task

Analyse what is required in a seismometer, and make a model.

This could be as simple as a stack of blocks (as seen on page 26 of *Australian Backyard Earth Scientist*), a pendulum or a metastable ball resting on a risky base—or something entirely different. Much of the learning will come from the experience of analysing the problem.

Extension Activity

Using the available technology in the school, make a seismometer capable of detecting very small vibrations. (Hint: try using a steel ball pendulum and a reed switch.)

Caution!

If heavy weights or blocks are used, ensure students wear safe footwear.

Seeking Fossils in Building Stone

This activity refers to material around pages 75 to 83.

Equipment

You will need:

- access to a reasonably large city with a lot of grand architecture using lots of stone. If you live in a small town, try looking in the local cemetery
- a camera.

The Task

Find and photograph as many fossils as you can; the number and kind of fossils you will be able to find will depend on the geology of your local area, and where local building stones came from.

Left to right: Nordic Museum Stockholm, Sweden; a snail and a graptolite in the middle of a trail, Maligne Canyon, British Columbia; fossil worm holes near Sydney.

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Extension Activity

Produce and publish a web page of fossils in public view in your city.

A Wet and Dry Bulb Thermometer

This activity refers to material around pages 154 and 155.

Equipment

You will need:

- the table on page 155
- at least one thermometer
- water
- cloth.

The Task

Find the relative humidity, using the instructions in the second column of page 155.

Creating a Clock or Pie Chart for the Planet

This activity refers to material around page 6.

Equipment

You will need:

- a copy of page 6 of *Australian Backyard Earth Scientist*
- a calculator
- a notebook
- a protractor
- drawing instruments, or a computer with a printer.

The Task

Either individually or in small groups, convert the table of geological eras into a 12-hour clock, with the start of each era shown around the edge.

Example: the Hadean era lasted 540 million years, so it lasted $^{540}/_{4,540}$ = 11.89% of the Earth's age. That would be 42.8° of the circle, and with 30° representing an hour, the Hadean ended at about 1:25 on the clock.

Extension Activity

Put the data into a spreadsheet. Use the spreadsheet to generate a pie chart.

The Components of the Planet

This activity refers to material around page 17.

Equipment

You will need:

- a copy of page 17 of *Australian Backyard Earth Scientist*
- a calculator
- a notebook
- a protractor
- drawing instruments, or a computer with a printer.

The Task

Using the data provided in the second column on page 17, produce pie charts of the component masses, the elements in the crust and the elements in the planet.

Extension Activity

Enter the data into a spreadsheet, and use that to generate a pie chart.

YEAR LEVEL: 8

Science Understanding

Chemical Sciences

Properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151)

Differences between elements, compounds and mixtures can be described at a particle level (ACSSU152)

Chemical change involves substances reacting to form new substances (ACSSU225)

Earth and Space Sciences

Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales (ACSSU153)

Physical Sciences

Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155)

Activities

Kinetic Energy and Heat

This activity refers to material around page 4.

Equipment

You will need:

- a desk.

The Task

Hold your finger down hard on your desk.

Move it back and forth, fast, for about ten seconds. What happens? (Kinetic (movement) energy has been converted to heat energy.)

Making a Rock Collection on a Beach

This activity refers to material around page 74.

It could be holiday project, or an activity during a school camp if it is close to the sea.

Equipment

You will need:

- a bag or large pocket
- access to a beach
- sun protection.

The Task

Collect one or two of each kind of rock.

Extension Activity

Conduct research to find out why beach pebbles take up a certain shape.

A Sock Full of Granite

This activity refers to material on page 61. It also appears in these notes as a Year 7 activity.

Equipment

You will need:

- a brick
- an old table
- a hammer
- a thick old sock
- a blanket or wads of newspaper
- a piece of granite (granite fragments can be found in granite country, but stone yards are also a good source)
- safety goggles
- a large cardboard box
- Petri dishes.

The Task

Lay the blanket or wads of newspaper on the table.

Place the brick onto the blanket or newspaper.

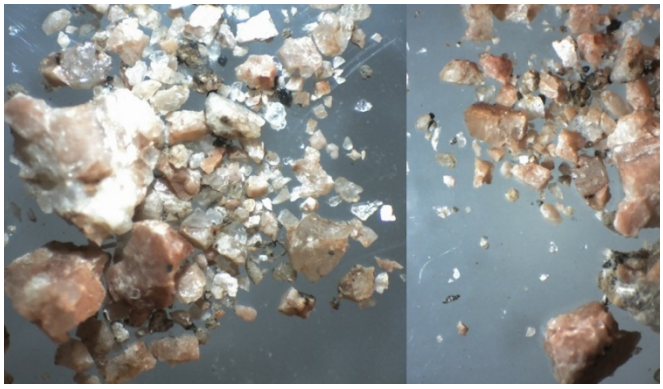
Put the granite in the sock and lay the sock on the brick.

Put on your safety goggles. Hit the sock with the hammer to smash the granite into fragments.

Divide the fragments into Petri dishes to share around the class.

Examine the fragments.

Note: many of the bits will be made up of crystals of a single kind, others will still be mixed.



Granite fragments

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Caution!

If the sock bursts, bits of granite may fly out—so unless *all* students have safety goggles, put the brick and sock down inside the cardboard box. Wear safety goggles yourself.

Extension Activity

How many kinds of crystal can you see in the fragments? How do you know they are different?

Photographing Naphthalene Crystals

This activity refers to material on page 57.

Equipment

You will need:

- naphthalene mothballs
- a clean jar with a tight lid.

The Task

Set the jar up as shown on page 57 of *Australian Backyard Earth Scientist*.

Leave it on a sunny windowsill.

After a week, there will be visible crystals. Observe what happens over time.

Caution!

Naphthalene is a household poison. Do not allow students to open the jar, or sniff or touch the naphthalene.

Making Borax Crystals

This activity refers to material around page 57.

Equipment

You will need:

- borax (try the laundry section of the supermarket)
- spoons or spatulas to hand out the borax
- warm water
- a Petri dish or saucer
- a microscope, clip-on or hand lens (optional).

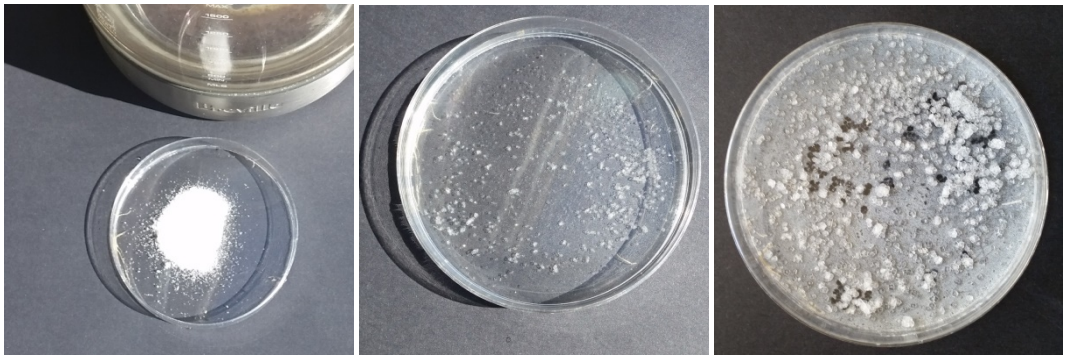
The Task

Ideally:

- add warm water to a beaker.
- keep adding borax crystals and stirring, until no more crystals dissolve.
- decant off the saturated solution into Petri dishes.

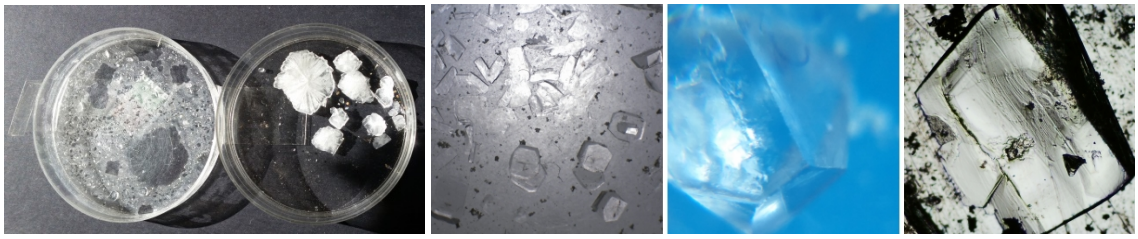
Alternatively:

- dissolve a 10 cent coin-sized amount of borax in 3 millimetres of warm water in 10-centimetre Petri dishes.



Left to right: borax in dish, ready for warm water; crystals forming one hour after being put in the sun on black paper; 24 hours later

Leave the dishes in a safe place, with the lid off, to wait for the water to evaporate. Depending on how you look at it, you will see something like this:



Left to right: image taken with a camera; image taken with a microscope; image taken with a clip-on; image taken with a microscope.

(Remember the underlying message: crystals form when identical units pack together.)

Extension Activity

Can you get bigger crystals? You will probably need to do some research.

Caution!

It is advisable to introduce borax to students as a poison, even though it is only rated 'hazardous'.

Students should not touch, inhale or swallow borax. They should use eye protection and gloves.

You may like to introduce students to the notion of a Material Safety Data Sheet, or MSDS (enter *MSDS borax* into a search engine).

Science as a Human Endeavour

Nature and Development of Science

Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134)

Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures (ACSHE226)

Use and Influence of Science

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity (ACSHE121)

Activities

Flat Earth to Plate Tectonics

This activity refers to material in *Australian Backyard Earth Scientist*, especially pages 4 to 9. It also appears in these notes as a Year 7 activity.

Equipment

You will need:

- a copy of *Australian Backyard Earth Scientist*
- internet access.

The Task

Read *Australian Backyard Earth Scientist* to find out how our knowledge of the planet changed. Create a timeline showing how our understanding of the Earth has changed.

Extension Activity

'Taking from one source is plagiarism, taking from many sources is research.' Get onto the web and search out the key terms, starting with the ones on pages 4 to 9 and building up. Now tell the story of how our understanding of the Earth changed *in your own words*.

Science Inquiry Skills

Questioning and Predicting

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS139)

Planning and Conducting

Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS140)

Measure and control variables, select equipment appropriate to the task and collect data with accuracy (ACSIS141)

Processing and Analysing Data and Information

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS144)

Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSIS145)

Evaluating

Reflect on scientific investigations including evaluating the quality of the data collected, and identifying improvements (ACSIS146)

Use scientific knowledge and findings from investigations to evaluate claims based on evidence (ACSIS234)

Communicating

Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSIS148)

Activities

Mapping the World's Volcanoes

This activity refers to material around pages 34 to 41.

Equipment

You will need:

- a world outline map (a more limited outline map could be substituted, such as the Pacific Ocean, or Indonesia and Papua New Guinea, or western Pacific plus Indonesia)
- access to the internet
- notebooks.

The Task

Identify all volcanoes that were active at some point between 1901 and now. To do this, you will need to agree on a definition of 'active'—it's recommend that this include ejecta (ash, lava or bombs) but not 'smoke' or fumes.

Note each volcano in your notebook, and give each a number.

Mark the volcanoes on your map by number.

Mt Etna, Italy (left); Mt Yasur, Vanuatu (right). Are both these volcanoes 'active'?

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes

AUSTRALIAN CURRICULUM CONTENT: HASS—GEOGRAPHY

YEAR LEVEL: 7

Geographical Knowledge and Understanding

Unit 1: Water in the World

Classification of environmental resources and the forms that water takes as a resource (ACHGK037)

The way that flows of water connects places as it moves through the environment and the way this affects places (ACHGK038)

The quantity and variability of Australia's water resources compared with other continents (ACHGK039)

The nature of water scarcity and ways of overcoming it, including studies drawn from Australia and West Asia and/or North Africa (ACHGK040)

Activities

Several of these activities also appear in these notes as science activities.

Making Mud Cracks

This activity refers to material around page 107.

Equipment

You will need:

- suitable mud—either already cracked (so you know it will work) or wet and really sticky
- plastic bags
- water
- a flat dish
- 50-cent coin
- camera.

Dried mud, Bondi, New South Wales (left); Australian tourists caught in sticky mud, Moroccan desert (right)

The Task

Collect some dried mud in the plastic bag and tie it off. Put that in a second plastic bag, tie it off and take it home.

Find somewhere safe, like a garden shed. Mix the mud with water. Stir the mud well, and leave it to dry in the flat dish.

Take photos twice a day, if you can, including the 50-cent coin for scale. How soon did the cracking start?

A Wet and Dry Bulb Thermometer

This activity refers to material around pages 154 and 155.

Equipment

You will need:

- the table on page 155 of Australian Backyard Earth Scientist
- at least one thermometer
- water
- cloth.

The Task

Find the relative humidity, using the instructions in the second column of page 155.

Natural Water near Us

This activity refers to material on pages 127 to 145.

Water seeping out of dunes on Soldiers Beach, near The Entrance, New South Wales (left and centre); a rock pool near Sydney (right)

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

None.

The Task

Describe a scenario for your students in which the usual water supply has failed—for example, damage to the water main which will take six weeks to fix.

Discuss: where could you go (nearby) to get water?

Extension Activity

Discuss: what would you need to do before drinking that water? Why?

For teachers: look for answers including but not limited to: contamination from dead animals, bacteria, viruses, amoebae, worm eggs, algal blooms, mud and clay solids, dissolved chemicals, salt, run-off from farms.

Floating Ice

This activity refers to material around pages 128 to 131.


Calved-off glacial ice, Glacier Bay, Alaska (left); glacial ice with seagulls (right)

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

You will need:

- ice cubes from the freezer
- a bowl of water.

The Task

Before showing students the pictures, ask:

- why is it important for wildlife that ice floats? Hint: polar bears and walruses!

Extension Activities

Why is it important for fish that ice floats?

(This is a tricky one! Ask students to think about it overnight. If they are still stumped the next day, explain that if ice sank, it would fall to the bottom and the seas would get shallower. As it is, ice stays up near the surface and melts in the sun.)

Make an ice lens (see Resources list at the end of these notes).

Cloud Watch

This activity refers to material around page 153.

Equipment

You will need:

- internet access
- cameras
- notebooks.

The Task

Have the class, working individually or in small groups, come up with a list of cloud types. (If students need help, direct them to the Bureau of Meteorology's information about clouds).

Over the next fortnight, ask students to observe and take photos of as many different cloud types as possible.

Extension Activities

Research and find pictures of lenticular cloud.

Tide Watch

This activity refers to material around pages 177 to 183.

King high tide, Sydney, January 2018, breaching the first lines of defence

For larger versions of these images for teaching purposes, see the Resources list at the end of these notes.

Equipment

You will need:

- access to a beach
- an accurate watch
- a tide chart for your area (available online)
- a stick, about 50 centimetres long
- sun protection.

The Task

Every port has a place where tidal data are taken—but, upstream and downstream, the high tide can be earlier or later.

Get to the beach half an hour before 'official' high tide.

Mark the highest point the next wave reaches with the stick, poking it at least 30 centimetres into the sand. Note the time.

Repeat this each time a higher wave comes in.

When no higher wave has come in for 15 minutes, the last recorded time is your local high tide time

Tip: don't be tricked by boat wash!

Extension Activities

Repeat the exercise on low tide times, marking the furthest withdrawal of the water in a similar way.

Alternatively, test a series of beaches upstream and downstream to see if there is a pattern.

Australian Alternative Energy Sources

This activity refers to material around pages 50 and 51.

Equipment

You will need:

- internet access.

The Task

Come up with a list of the forms of renewable energy in use in Australia at the moment.

Do we use:

- geothermal
- solar
- wind
- tidal
- hydroelectric power?

Where? How close is it to us?

Extension Activity

Look up 'Thargomindah'. What is significant about it in terms of energy sources? (Hint: the year 1898 was important in its history.)

Where is the above potential (untapped) source of tidal energy to be found?

Answers may be found at the end of these notes.

The Components of the Planet

This activity refers to material around page 17.

Equipment

You will need:

- a copy of page 17
- a calculator
- a notebook
- a protractor
- drawing instruments, or a computer with a printer.

The Task

Using the data provided in the second column two on page 17, produce pie charts of the component masses, the elements in the crust and the elements in the planet.

Extension Activity

Enter the data into a spreadsheet, and use that to generate a pie chart.

Locating and Mapping Fossil Fuel Sources

This activity refers to material on or about page 84.

Equipment

You will need:

- internet access.

The Task

Where do we get our coal, oil and gas? (You may like to tackle this on a national, state or local level.)

Plot these sources on a map.

What conclusions could we can draw from this?

Mining a Chocolate Chip Cookie

This activity refers to material around pages 86 and 87.

Equipment

You will need:

- one chocolate chip cookie per person
- a plate.

The Task

Instruct the students to pull the cookie apart, and extract as many choc chips as possible.

Now tell the students to put the cookie back as it was.

Talk about the fact that, when you are mining for chocolate chips, it's impossible to make things as they originally were.

Our civilisation relies on extracting minerals. How can we get the resources we need, while minimising the harm? Discuss.

Extension Activity

Find out about, and compare:

- Las Medulas, Spain
- Malakoff Diggins, California
- Oriental Claims, near Omeo in Victoria.

YEAR LEVEL: 8

Geographical Knowledge and Understanding

Unit 1: Landforms and Landscapes

Different types of landscapes and their distinctive landform features (ACHGK048)

Geomorphic processes that produce landforms, including a case study of at least one landform (ACHGK050)

Human causes and effects of landscape degradation (ACHGK051)

Causes, impacts and responses to a geomorphological hazard (ACHGK053)

Activities

These activities also appear in these notes as science activities.

Erosion near Here

This activity refers to material around pages 108 to 117.

Equipment

None.

The Task

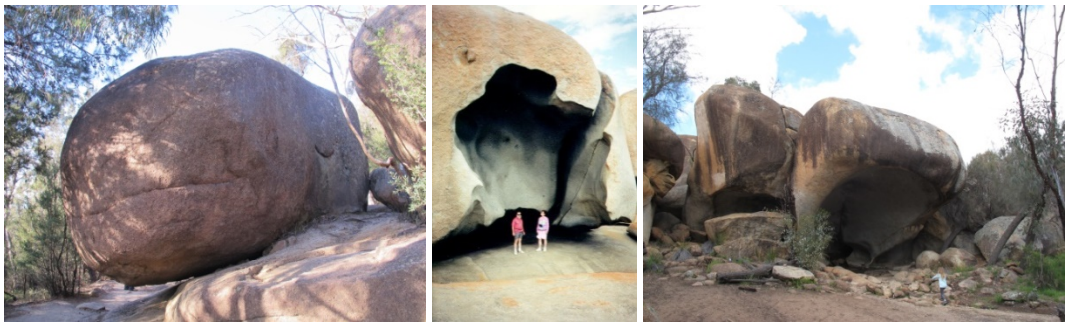
Identify local areas where erosion is happening.

Extension Activities

Work out some ways to stop the erosion—for example, using logs or rocks to slow the water flow.

The Nearest Granite Tors

This activity refers to material around page 94.



Granite boulders can vary. Left to right: Freycinet Peninsula, Tasmania; Remarkable Rocks, Kangaroo Island, South Australia; Wave Rock area, Western Australia

Equipment

You will need:

- access to granite outcrops in your local area.

The Task

Start with Banjo Paterson's poem, *Been There Before* (see the Resources list at the end of these notes). Discuss the lack of stones or rocks in some places.

Discuss what qualifies as a tor, using the pictures above. Work out how far you have to go to see tors. They may be closer than you think.

Identifying Local Weathered Rock

This activity refers to material around pages 88 to 97. It also appears in these notes as a Year 4 science activity, but can here be dealt with more rigorously.

Start with Banjo Paterson's poem, *Been There Before* (see the Resources list at the end of these notes). Discuss the lack of stones or rocks in some places.

Equipment

You will need:

- access to weathered rock faces and rock surfaces in your local environment, for example:
    - naturally occurring rock faces
    - road cuttings*
    - old stone buildings
    - tombstones.

The Task

Find a variety of weathered surfaces in your area. Take photos or make drawings.

Discuss:

- where are the nearest examples of weathering?
- what caused the weathering?

Caution!

* Students should take care when making observations near roads.

Two examples of spectacular weathering. Uluru, Northern Territory (left); Dinner Table Rocks, near Berry, New South Wales (right)

CONCLUDING ACTIVITIES

Mining a Chocolate Chip Cookie

This activity refers to material around pages 86 and 87.

Equipment

You will need:

- one chocolate chip cookie per person
- a plate.

The Task

Instruct the students to pull the cookie apart, and extract as many choc chips as possible.

Now tell the students to put the cookie back as it was.

Talk about the fact that, when you are mining for chocolate chips, it's impossible to make things as they originally were.

Our civilisation relies on extracting minerals. How can we get the resources we need, while minimising the harm? Discuss.

Extension Activity

Find out about, and compare:

- Las Medulas, Spain
- Malakoff Diggins, California
- Oriental Claims, near Omeo in Victoria.

Looking at Tree Rings

This activity refers to material around pages 212 and 213.

Equipment

You will need:

- a log or stump
- sandpaper
- oil or varnish
- tape or ruler
- a camera or clip-on (optional).

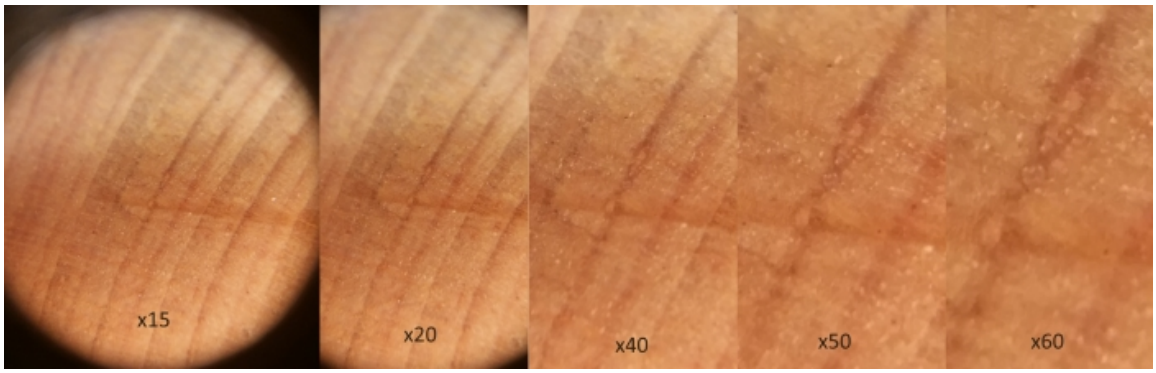
The Task

Follow the instructions on page 213.

Note: a roughly-sawn log like the one shown here, cut with a chainsaw, is hard to examine. Oiling or varnishing helps the rings stand out. For best results, sand the surface.

Caution!

Take extreme care if using power tools such as electric saws and sanders. Proper advice, training or supervision is essential. Protect hands, eyes and hair.



Progressively closer views, taken with a clip-on

Locating and Mapping Fossil Fuel Sources

This activity refers to material around page 84.

Equipment

You will need:

- internet access.

The Task

Where do we get our coal, oil and gas? (You may like to tackle this on a national, state or local level.)

Plot these sources on a map.

What conclusions could we can draw from this?

Getting Pictures of Weathered Rock near Home

This activity refers to material around pages 88 to 97.

Equipment

You will need:

- camera
- transport
- appropriate clothing
- access to weathered rock faces and rock surfaces in your local environment, for example:
    - naturally occurring rock faces
    - road cuttings*
    - old stone buildings

- tombstones.

The Task

Photograph a wide range of weathered rock faces.

Extension Activity

Classify the various types of weathering.

Modelling Crystals with Marbles

This activity refers to material around page 56.

Equipment

You will need:

- a set of marbles (at least a dozen)
- a rectangular tray

or

- at least a dozen identical balls (golf, table tennis or tennis)
- a flat rectangular box.

The Task

Drop balls into a box.

Shake gently.

Observe what happens.

Compare the result with the gumball machine shown on page 56.

Discuss the fact that when identical units are brought together they pack in. Atoms and molecules rattle around randomly and pack together to form crystals.

Extension Activity

Find the same effect at your local supermarket.

Soil Studies

This activity refers to material around pages 104.

Equipment

You will need:

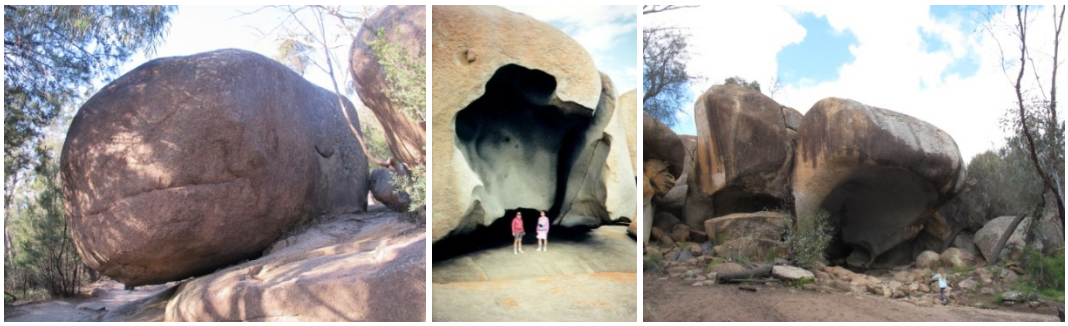
- a tall glass jar with a lid (for example, an instant coffee jar)
- several soil samples
- water
- a camera (optional).

The Task

Carry out the project on page 104.

The Nearest Granite Tors

This activity refers to material around page 94.



Granite boulders can vary. Left to right: Freycinet Peninsula, Tasmania; Remarkable Rocks, Kangaroo Island, South Australia; Wave Rock area, Western Australia

Equipment

Granite outcrops in your local area.

The Task

Start with Banjo Paterson's poem, *Been There Before* (see the Resources list at the end of these notes). Discuss the lack of stones or rocks in some places.

Discuss what qualifies as a tor, using the pictures above. Work out how far you have to go to see tors. They may be closer than you think.

The Closest Volcano to Us

This activity refers to material around pages 36 to 41.

Equipment

You will need:

- internet access.

The Task

Find the (often surprising) answer to the question: Where is the nearest volcanic remnant to us here?

Note: you may decide that any basalt (even dykes and sills) count.

Extension Activity

Look at some geological sheets (maps). Locate tuffs, basalt flows and other volcanic features.

Tabletop Humus-Making

This activity refers to material around pages 216 and 217.

Equipment

You will need:

- an airtight plastic container (for example, a takeaway food container)
- clean sand
- water
- dead leaves
- pill bugs
- a pinch of leaf litter.

The Task

Follow the instructions on pages 216 and 217.

Extension Activity

Adding fresh leaves once a week, see how long you can keep your humus going.

Identifying Local Weathered Rock

This activity refers to material around pages 88 to 97.

Start with Banjo Paterson's poem, *Been There Before* (see the Resources list at the end of these notes). Discuss the lack of stones or rocks in some places.

Equipment

You will need:

- access to weathered rock faces and rock surfaces in your local environment, for example:
    - naturally occurring rock faces
    - road cuttings*
    - old stone buildings
    - tombstones.

The Task

Find a variety of weathered surfaces in your area. Take photos or make drawings.

Discuss:

- where are the nearest examples of weathering?
- what caused the weathering?

Caution!

* Students should take care when making observations near roads.

Two examples of spectacular weathering. Uluru, Northern Territory (left); Dinner Table Rocks, near Berry, New South Wales (right)

Answers to Extension Activity Questions

The Thargomindah question: see page 106 in *The Big Book of Australian History*.

The tidal power source in Australian alternative energy sources is at the Horizontal Falls, not far from Broome.

Resources

Banjo Paterson's *Been There Before*

Guide to Go Micro clip-on microscope

Teaching pictures for *Australian Backyard Earth Scientist*

Useful Websites

Clouds (Australian Bureau of Meteorology)

Enquiring into Sight and Light (making and ice lens, and other fun stuff)

Old Writer on the Block (Peter Macinnis' blog)

Tsunamis (Australian Bureau of Meteorology)

Meteor Shower Data

To get data for Australia in any given year, enter *'meteor showers' Australia* into your search engine, or see:

- Stardate (US data)
- Look Up! Your Guide to Some of the Best Meteor Showers. These lists give details of meteor showers occurring each year e.g. Look Up! Your Guide to Some of the Best Meteor Showers. 2018. To find meteor showers occurring this year, do an internet search including the current year e.g. *Look Up! Your Guide to Some of the Best Meteor Showers 2019*.

Facebook Groups and News

Facebook groups worth looking at for teachers:

- Geologists Drinking Beer (not for students!)
- Geoscience Education Division of the Geological Society of America.

The Geology Page: a subscription to their emails will keep you on top of the news

Further Reading

Books

Marcia Bjornerud, *Reading the Rocks: the Autobiography of the Earth*. New York: Basic Books, 2007

John S. Dickey Jr, *On the Rocks: Earth Science for Everyone*. New York: John Wiley & Sons

Ari Trausti Guðmundsson, *Living Earth: Outline of the Geology of Iceland* (trans. George Douglas). Reykjavik: Mál og menning, 2015

Roger Osborne, *The Floating Egg*: *Episodes in the Making of Geology*. London: Pimlico, 1999

David A. Rothery, *Geology: the Key Ideas*. Abingdon: Hodder Headline, 2010

J. William Schopf, *Cradle of Life: The Discovery of Earth's Earliest Fossils.* Princeton, NJ: Princeton University Press, 1999

Griffith Taylor, *Sydneyside Scenery and How it Came About*. Sydney: Angus and Robertson, 1958

Simon Winchester, *A Crack in the Edge of the World: America and the Great California Earthquake of 1906.* New York: Harper Perennial, 2006

Simon Winchester, *The Map that Changed the World: William Smith and the Birth of Modern Geology*. New York: HarperCollins, 2001

Jan Zalasiewicz, *The Planet in a Pebble*. Oxford: Oxford University Press, 2010

Also consider the Discworld novels of Terry Pratchett, as another paradigm in the context of the shape of the planet. These books have lots of clever science—excellent fun for bright teens.