

Plate Tectonics Part 2: Tectonic Plates and Australia

EARTH AND SPACE SCIENCES



QGC

FUTUREMAKERS



**QUEENSLAND
MUSEUM NETWORK**



**Queensland
Government**

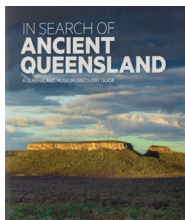
Introduction

The Queensland Museum Network has one of the largest and most significant Geosciences Collections in the southern hemisphere. The Geosciences Collection consists of 55,000 geological samples and 27,000 mineral samples, as well as over 7 million fossil specimens! This includes nearly 10,000 primary type specimens (reference specimens used to identify, name and classify fossil plant or animal species).

The Geosciences Collection contains pivotal resources that help scientists to:

- Discover and document past Australasian biodiversity as revealed from the fossil record.
- Interpret the evolutionary history of animals and plants over 3000 million years.
- Understand the geological history of Australia and how that impacted upon both terrestrial and marine ecosystems.
- Understand historical environmental changes in Australia as seen in the fossil record.
- Interpret past climates and understand how living things responded to these climatic and environmental changes.
- Use historical data to predict future trends, and infer how ecosystems may respond to the changing climate and environment.

This resource may be used individually or with the Queensland Museum online resources ‘*Plate Tectonics Part 1-3*’, and ‘*Volcanoes*’.



Much of this information has been sourced from the book ‘*In Search of Ancient Queensland*’ which can be purchased from the Queensland Museum shop in-store or [online](#) (ISBN: 9780977594306). More information and fossils from ancient Queensland can be seen in the Queensland Museum’s *Lost Creatures* exhibition, Brisbane.

Future Makers is an innovative partnership between Queensland Museum Network and Shell’s QGC project aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

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Activity Overview

Plate Tectonics and Australia

Within the following activities you will work as a Queensland Museum scientist to:

1. Predict how the historical geographical location of Australia would influence flora and fauna.
2. Construct a map of the current Earth using tectonic plates, and use this map to identify the geological features and events that occur at different plate boundaries.

Teacher Tips

- Get students working in groups of 3 – 4 to for collaborative learning and communication.
- Model how the table can be filled out as a class, using the skills of a scientist including observation, inference and hypothesising.
- Remind students that they are making a prediction, and as long as they have a clear justification based on current evidence there is no right or wrong answer (no humans were around 45 million years ago to say conclusively!). This can lead to an interesting class discussion.
- The map of ‘Our Earth’s Tectonic Plates’ can be printed in A3 and the plates may be laminated and saved for future use (whiteboard markers can then be used to add geological features and events).
- Students may want to research geological features and events such as volcanoes, earthquakes, mountains and trenches to add to their maps, or they may each choose one feature/event and present results to the class.

Assumed knowledge

- Structure of the Earth.
- The lithosphere is broken into tectonic plates that move.
- Plate boundaries may be convergent (destructive), divergent (constructive) or transform (conservative).
- Theory of continental drift - the position of the continents has changed over time.

Australian Curriculum Links

Year 9

Science Understanding

The theory of plate tectonics explains global patterns of geological activity and continental movement (ACSSU180)

Science as a Human Endeavour

Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community (ACSHE157)

Science Inquiry Skills

Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (AC SIS170)

Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (AC SIS174)

Year 6

Science Understanding

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

Science as a Human Endeavour

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

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

Science Inquiry Skills

Compare data with predictions and use as evidence in developing explanations (AC SIS221)

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (AC SIS110)

Numeracy

Estimating and calculating with whole numbers

Using spatial reasoning

Using measurement

Activity 1

Australia's Geological History

Palaeogeography (pale-e-o-geography) is the study of the geography of the past, while palaeoecology (pale-e-o-ecology) is the study of relationships between organisms in past environments. Images and statements about the palaeogeography and palaeoecology of Australia can be seen in Table 1 (page 5) and Table 2 (page 6). During this time the landmasses split apart and then moved back together a number of times.

Objective

To understand the continental movement of Australia and how this affected the environment.

Activity

1. You are the expert! Match the correct paleogeography statement (Table 1) with the position of Australia on the Earth image (Table 2). This may be cut out and glued into the table, or copied and pasted digitally.
2. What was the environment like? Make a hypothesis about the flora and fauna that may have lived in this environment.

*Hint: Think of similar climates that exist today and/or research the time period for help. You may choose to draw a picture or write a description.

Some points to consider:

- What was the latitude/distance from the poles? (Climates are generally colder in environments close to the poles e.g. the Arctic and Antarctica today).
- Areas in the middle of large landmasses often form deserts e.g. The Simpson Desert in Australia.



Figure 1: Australia during the Jurassic period. *Image: QM*

Table 1: Palaeogeography of Australia

(not in order)

<p>1. About 280 Ma (million years ago), all landmasses formed a giant supercontinent called Pangea. Australia drifted towards the South Pole with major effects on its climate. Most of the continent was covered by an ice cap. Volcanic activity extended along the eastern margins from Sydney to Cairns.</p>	<p>2. Around 130 Ma, Gondwana began to break up. Two landmasses resulted: a western half made up of Africa and South America, and an eastern half consisting of Antarctica and Australia. By 70 Ma, wide oceans had formed between Antarctica, Africa and India. Antarctica started drifting towards the South Pole.</p>
<p>3. Around 160 Ma, Pangea split apart forming the southern continent Gondwana, made up of Antarctica, Australia, Africa and India; and the northern continent, Laurasia. By 150 Ma, a rift valley formed between Australia and Antarctica. The sea covered the north-west Australian coastline. The climate warmed as Australia drifted from the South Pole.</p>	<p>4. Around 360 Ma, Pangea split in two forming a southern landmass (Gondwana), made up of Antarctica, Australia, Africa and India. The sea had receded in most parts of Australia but parts of eastern Australia and northern Western Australia remained covered and coral reefs flourished locally. Volcanic activity was widespread from central New South Wales to central Queensland.</p>
<p>5. Around 470 Ma, Australia was part of Pangea, a single ancient super-continent. Sea levels were high and most of eastern Australia was underwater with a small strip extending across the Northern Territory to Western Australia. Active volcanoes formed a chain across central New South Wales. Australia was close to the Equator and the climate was warm.</p>	<p>6. Around 45 Ma, the rift between Australia and Antarctica widened to form the Southern Ocean. Shallow seas covered parts of southern Australia. Volcanoes were active along eastern Australia and Tasmania. The climate was warm and humid as Australia moved north.</p>

KEY

Water

Existing landmasses

Australia

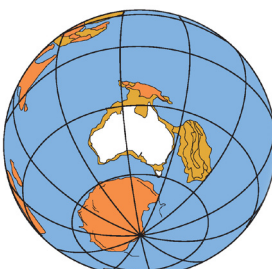
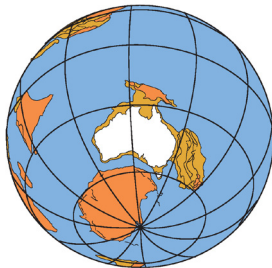
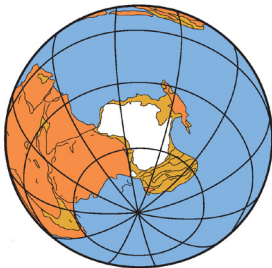
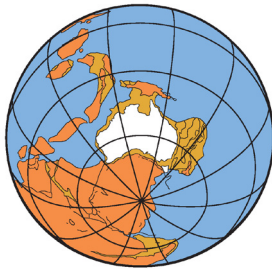
Land currently underwater

Table 2: Australia's Geological History

Position of Australia

Palaeogeography

What was the environment like?



Images: [Geoscience Australia](#)

3. Explain why Australia has so many unique plants and animals.

*Hint: Think of the movement of the Australian continent.

4. Monotremes are only found in Australia and New Guinea (the playpus is only found in Australia, while the echidna is found in Australia and New Guinea). Explain why these two countries have similar fauna.

Did you know?

Australia is still moving! The Indo-Australian plate moves north at about 7 cm per year. In 2016, our position had to be recalibrated because, due to continental drift, Australia had moved 1.5 m away from our GPS location on maps.

This accuracy is fine when using google maps on your phone; however, it can cause huge problems for technology that requires positional accuracy, such as self-driving cars. 1.5 m could be the difference between being on the road and crashing into a tree!

(See the video clip [‘Modernising Australia’s Datum’](#)- ICSM Analytic Committee on Survey and Mapping - by Small Island Studio on Vimeo for more information).

5. Using the information from the ‘did you know’ text box above, calculate how far Australia will move between now and 2085.

STEM Careers in Real Life: Dr Scott!

Dr Scott Hocknull, Senior Curator, Geosciences, Queensland Museum (Palaeontologist)

Discovering the past is the key to understanding the present and looking at the future. Dr Scott has loved dinosaurs, prehistoric animals and fossils since he was a child, deciding very early that he wanted to be a palaeontologist. In fact Dr Scott has been volunteering or working at the Queensland Museum since he was 12 years old. He published his first scientific paper in high school, and at 22 he was the youngest curator in Australia (and also became Young Australian of the Year at 24)!

One of the projects Dr Scott is working on involves recreating scientifically accurate representations of Queensland's fossil heritage, dinosaurs and megafauna, all in virtual reality. This will allow everyone to experience what it would be like to go to fossil sites across Australia. We will also be able to explore millions of specimens from the museum collection, from the microscopic to massive dinosaur bones! Virtual reality can even be used to venture back in time to be surrounded by prehistoric animals (and control dinosaur movement and interaction using an x-box controller)!

To learn more about this you can visit the *Lost Creatures* exhibition at the Queensland Museum, or watch Dr Scott talk about this amazing technology on his TEDx talk '[Dig to digital - breaking the 'rules' of museums](#)'. You can also check out Dr Scott's [profile](#) on the Queensland Museum website.

If you want to work like Dr Scott and learn more about Queensland's ancient past you can read about it in the book '*In Search of Ancient Queensland*'. Buy it at the Queensland Museum shop [here](#).



Figure 2: Dr Scott Hocknull at South Walker Creek Mine hunting tropical megafauna fossils.

Image: QM, Rochelle Lawrence, 2013.

“To look into our past, you gain a great understanding of our present and this provides a fantastic perspective on the future, especially in terms of future environmental change driven by climate, extinctions and the evolution of our planet’s many millions of species,”
Dr Scott says.

Activity 2

Plate Tectonics

From the highest mountain to the deepest trench, the theory of plate tectonics explains the features of the Earth, along with much of the geological activity we experience such as earthquakes and volcanoes.

The Earth's crust is divided into many plates that move around on top of the mantle. Convection currents caused by heat within the Earth drive the movement of these plates (Figure 3). The boundaries between the plates are where most geological activity occurs, either when the plates push together (convergent plate boundaries), move apart (divergent plate boundaries) or slide past one another (transform boundaries).

Did you know?

Scientists believe that in 200,000 years we could have another supercontinent as the Indo-Australian plate crashes into the Eurasian Plate. Austraeurasia anyone?

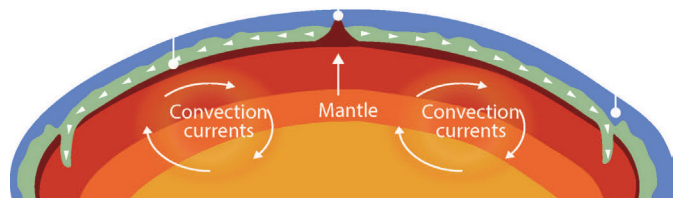


Figure 3: Slow moving convection currents within the mantle contribute to tectonic activity. *Image: QM, Angelina Martinez*

Objective

In this task you are required to cut out the tectonic plates to construct a map of the Earth. You will then do some research to determine the type of plate boundary, and the geological features and events that occur along each boundary.

Materials

- A copy of Our Earth's Tectonic Plates (page 12)
- Scissors
- Glue
- Highlighters
- Coloured pens

Method

1. Use the tectonic plates to construct a map of the Earth. Then add features to show type of plate boundary, geological features and events.

- a. Cut out the tectonic plates and glue them in the correct order to construct a map of Earth.
- b. Draw any mountain ranges and/or trenches that you know of. Remember to include a key.
- c. Highlight where the most earthquakes occur, and in a different colour where the most volcanoes occur.
- d. Use the geological features and activity on your map to predict whether each tectonic plate boundary is a convergent, divergent or transform boundary.

2. Explain what you notice about the location of geological features and activity along the plate boundaries. Be specific.

Our Earth's Tectonic Plates

Cut out the tectonic plates to construct a map of Earth.

