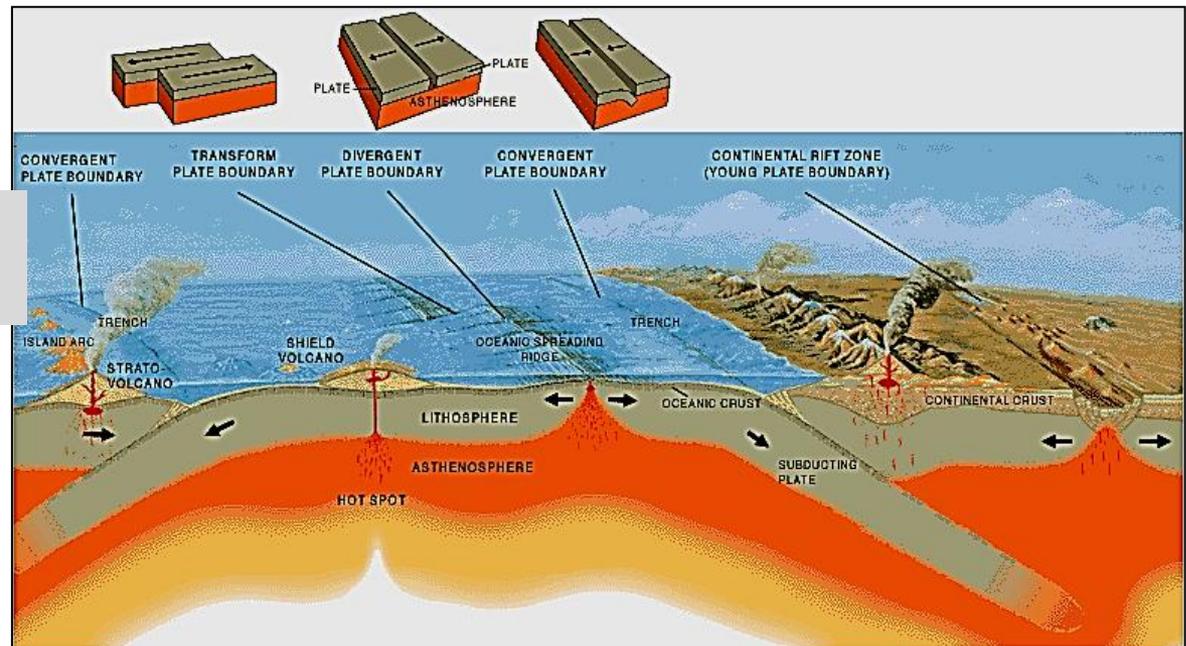


Plate tectonic processes affecting the
Earth's surface geology and landscapes.
(US Geological Survey, 1996)

Lithospheric plates

Enormous heat sources in the Earth's deep interior, acquired during the very early history of the planet billions of years ago continue to drive present-day geological processes at the surface. The outer "skin" of the Earth, the lithospheric rocks (plates), "float" on top of the hotter, more plastic, deep mantle rocks and move slowly, driven by convection currents within the Earth. These processes are commonly referred to as "**plate tectonics**".

- **Divergent boundaries** – usually (but not always) occurring in the middle of oceans where new crustal rock is formed, e.g. the central Southern Ocean between Australia and Antarctica.
- **Convergent boundaries** – where plates collide and one plunges under another at a 'subduction' zone, e.g. where Australia collides with Indonesia.
- **Transform boundaries** - where lithospheric plates slide past one another on strike-slip faults, e.g. along the Alpine Fault of New Zealand's South Island.



Geology of the Batemans Bay region

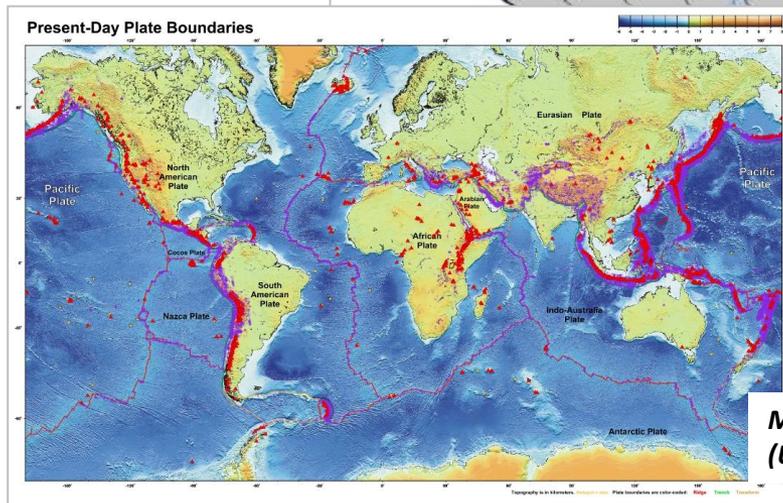
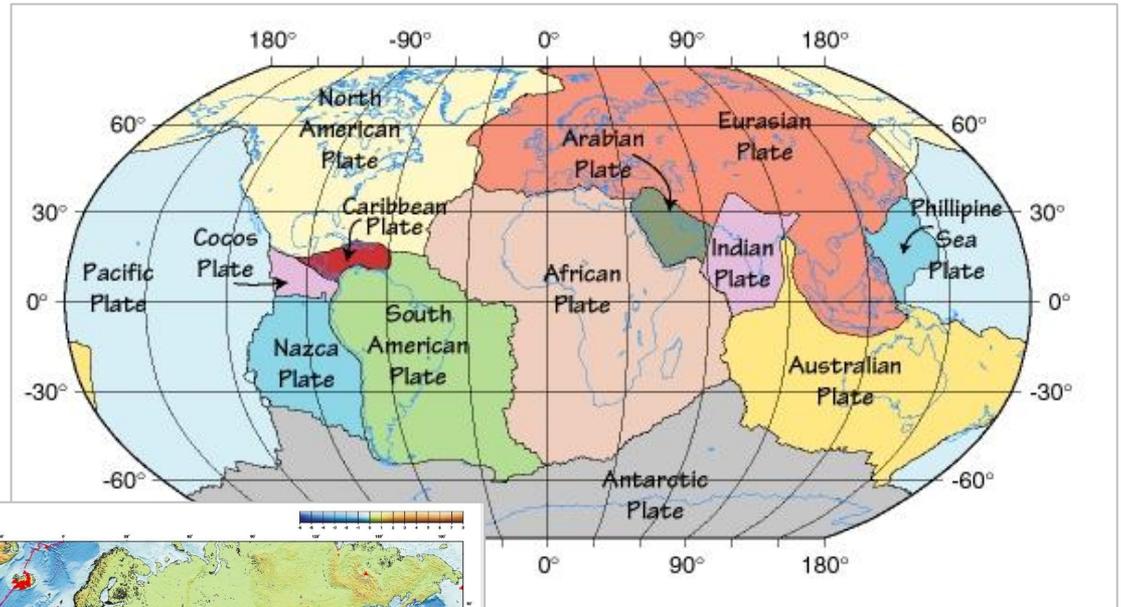
Tectonic processes

2

Major lithospheric plates around the world.
(US Geological Survey, 1996)

Lithospheric plates and earthquake/volcanic activity

Eight major lithospheric “plates” and many minor ones interact across the whole of the Earth’s surface, driven by the convection currents in the mantle. The interaction of these “plates” give rise to major earthquake zones and volcanism at convergent and divergent plate boundaries.



Major earthquake zones around the world.
(US Geological Survey, 1996)



Geology of the Batemans Bay region

Tectonic processes

3

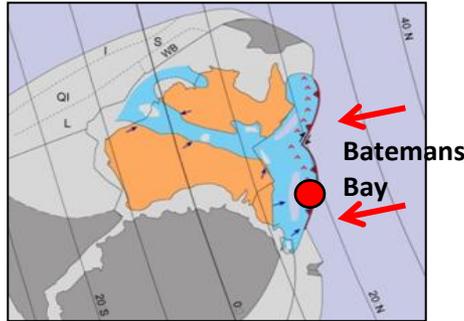
Eastern Australia was created near the equator, drifted to polar latitudes, and is now moving northwards towards Indonesia at about 7 cm every year.



Doug Finlayson
Canberra, 2016

Batemans Bay throughout its geological history

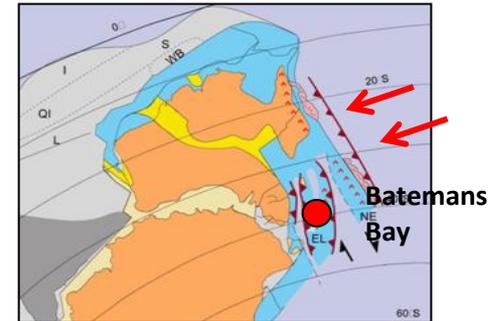
Ordovician, 480 Ma



About 480 million years ago, during the **Ordovician** geological period, the Australian continent was part of a larger supercontinent called Gondwana. Eastern Australia was near the equator and there was deep ocean where Batemans Bay now is located.

Huge amounts of sediment were being eroded from the supercontinent into a deep ocean. An oceanic plate was colliding with eastern Australia.

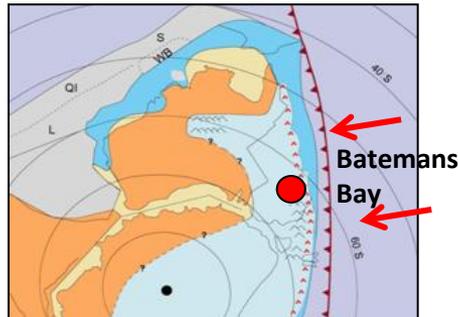
Devonian, 400 Ma



During the **Silurian** and **Devonian** geological periods the Batemans Bay region was still at tropical latitudes with warm shallow seas surrounding volcanic islands.

Australia was still part of the Gondwana supercontinent that included Antarctica, South America and India. An oceanic plate was still pushing against eastern Australia.

Carboniferous, 320 Ma



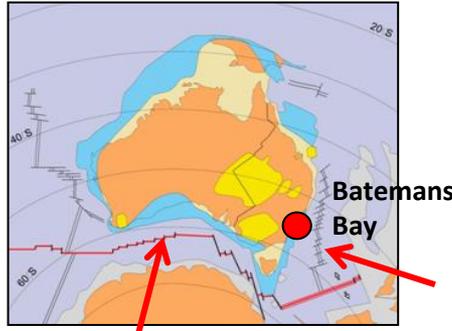
By the **Carboniferous** and **Permian** geological periods eastern Australia had drifted to polar latitudes and large parts were covered by glaciers and ice sheets. An ocean plate was still converging on the eastern Australian continent.

Geology of the Batemans Bay region

Tectonic processes

4

Eocene, 45 Ma



Tasman Sea opening

Southern Ocean opening

Batemans Bay coastline formed

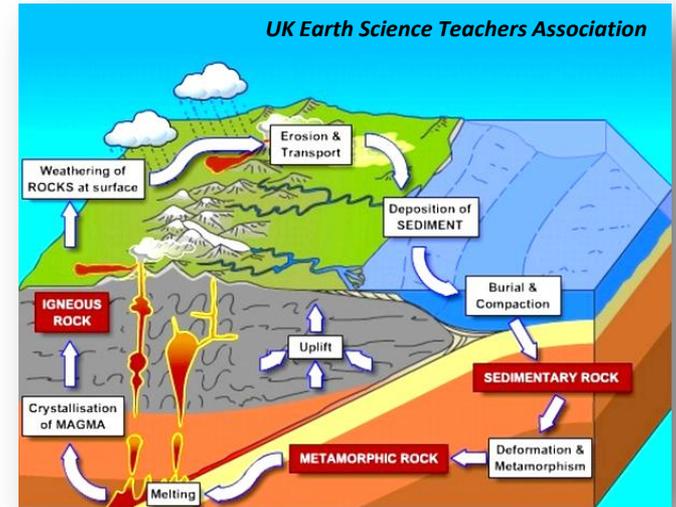
About 130 million years ago Gondwana began to break apart. Australia rifted from Antarctica and started drifting northwards. The Southern Ocean began opening up. By about 92 million years ago a rift along eastern Australia resulted in a large part of the continent separating off to form New Zealand and the Norfolk Ridge. The Tasman Sea began opening up. The coastline at Batemans Bay that we see today was formed.

The Rock Cycle

The rocks that we see at the Earth's surface today have been subjected to very significant physical and chemical processes during the many phases of their evolution throughout geological history. This is called the **Rock Cycle**.

Rocks may be formed near the surface or deep within the Earth. They may then be subjected to multiple cycles of heating, 'pressure-cooking', deformation and chemical alteration before being uplifted and exposed at the Earth's surface.

The rocks of the Batemans Bay region tell the story of events, processes and tectonic cycles from geological history that have shaped the landscapes that we see today.



Geology of the Batemans Bay region

Tectonic processes

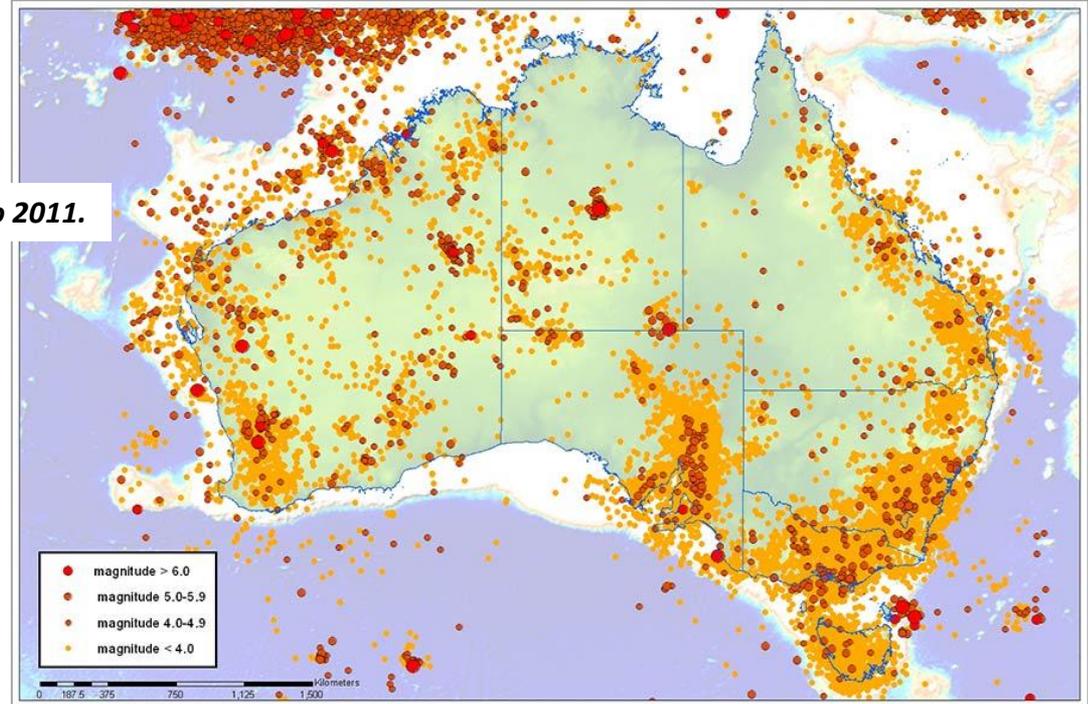
5

Landscapes are changing all the time.

Planet Earth is dynamic.

The Old Courthouse Museum
Batemans Bay NSW

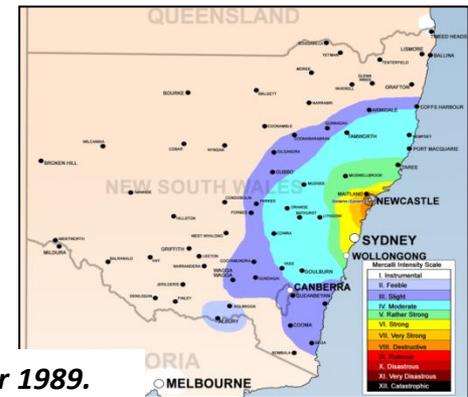
Earthquake locations up to 2011.



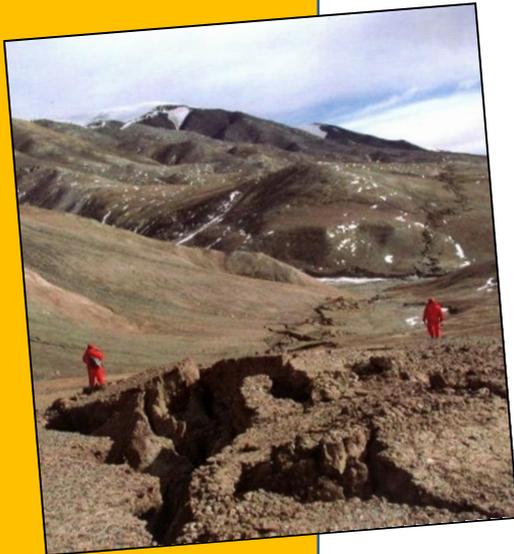
Geoscience Australia



Newcastle magnitude 5.6 earthquake, 28 December 1989.
Workers Club damage. Felt over a large area.



Doug Finlayson
Canberra, 2016



There are many sources of earth science information on web sites, in books, and in journals. Some of these are listed below.

Books and publications

- ***This Dynamic Earth: the story of Plate Tectonics*** - US Geological Survey, 1996.
- ***Geodynamic synthesis of Phanerozoic eastern Australia and implications for metallogeny*** – Geoscience Australia Record 2009/18.
- ***The Geology of Australia*** – David Johnson, Cambridge University Press, 2004.

Web sites

- <http://pubs.usgs.gov/gip/dynamic/understanding.html> US Geological Survey.
- <http://ds.iris.edu/seismon/> IRIS earthquake monitor.
- <http://earthquake.usgs.gov/learn/kids/> Earthquake hazards for kids; US Geological Survey.
- [http://education.nationalgeographic.com/media/plate-tectonics/Plate tectonic film.](http://education.nationalgeographic.com/media/plate-tectonics/Plate%20tectonic%20film)
- <http://www.esta-uk.net/resources.htm> UK Earth Science Teachers Association

Major tectonic events still happen all around the world

Kunlun Pass 8.1 Ms magnitude earthquake, Tibet, 14 Nov. 2001. The surface rupture was 426 km long; max left-lateral displacement 7 metres. It was one of the largest earthquakes in continental China.