

Geology of the Batemans Bay region

Landscapes

1

Landscapes around the world have been developed over millions of years by geological processes that are commonly known as the **Rock Cycle** and the **Water Cycle**.

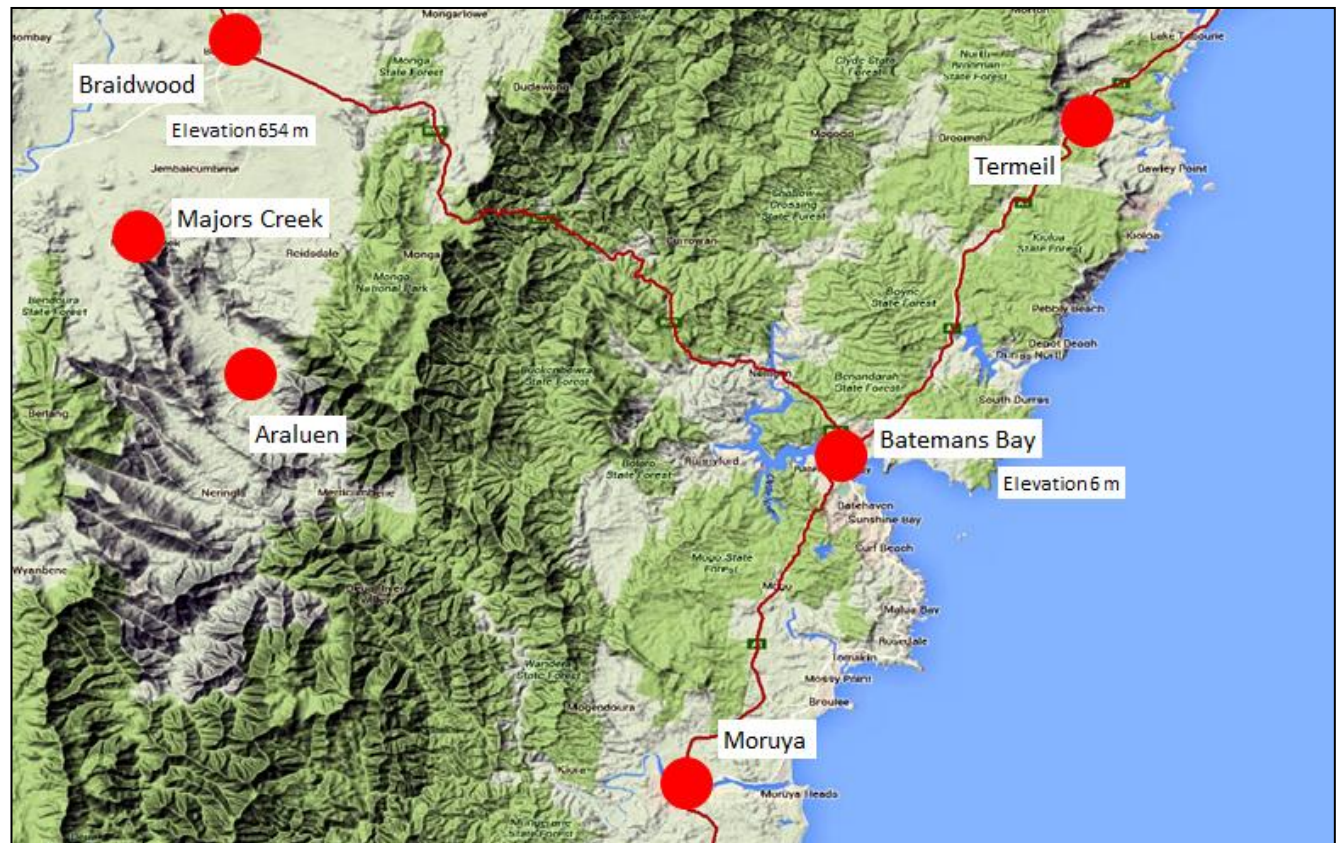


Doug Finlayson
Canberra, 2016

The Old Courthouse Museum Batemans Bay NSW

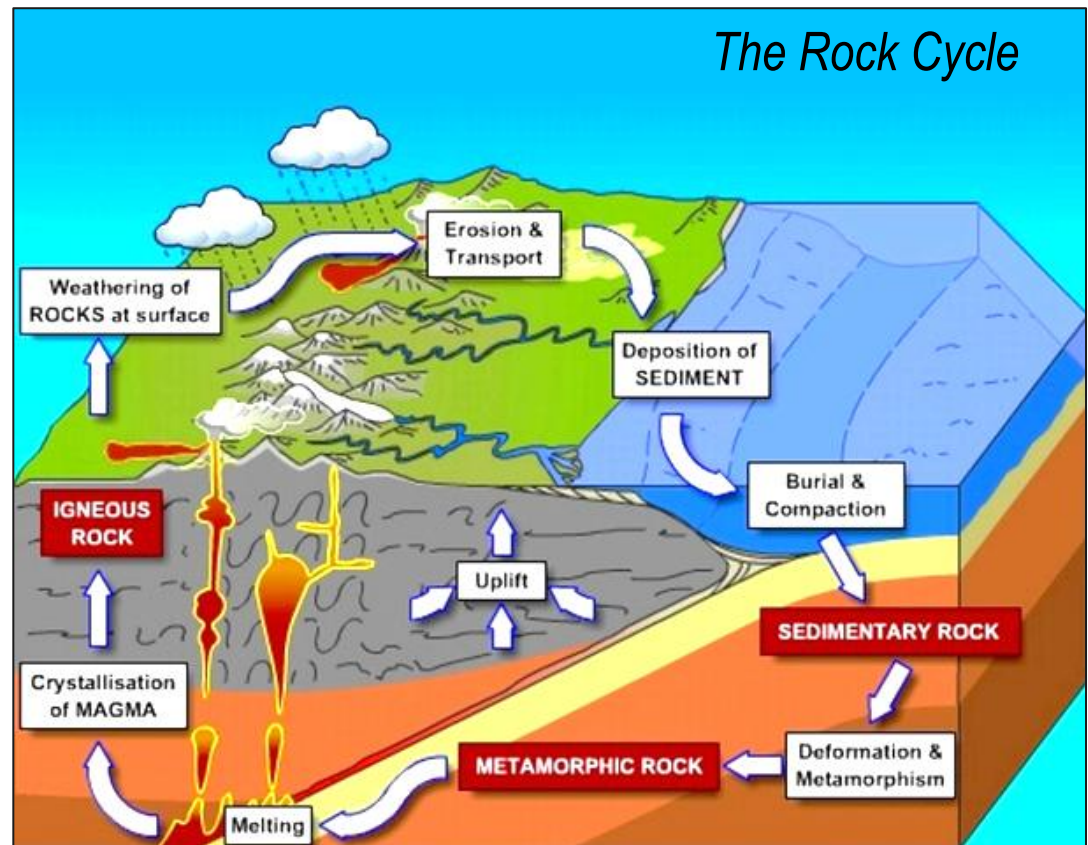
Landscapes around Batemans Bay

Plate tectonic forces acting around the world lead to the uplift of mountain ranges and the accompanying erosion caused by changes in rainfall and climatic patterns. Geology, uplift, climate, weather and erosion all lead to the pattern of creeks and rivers we now see in the Batemans Bay region.



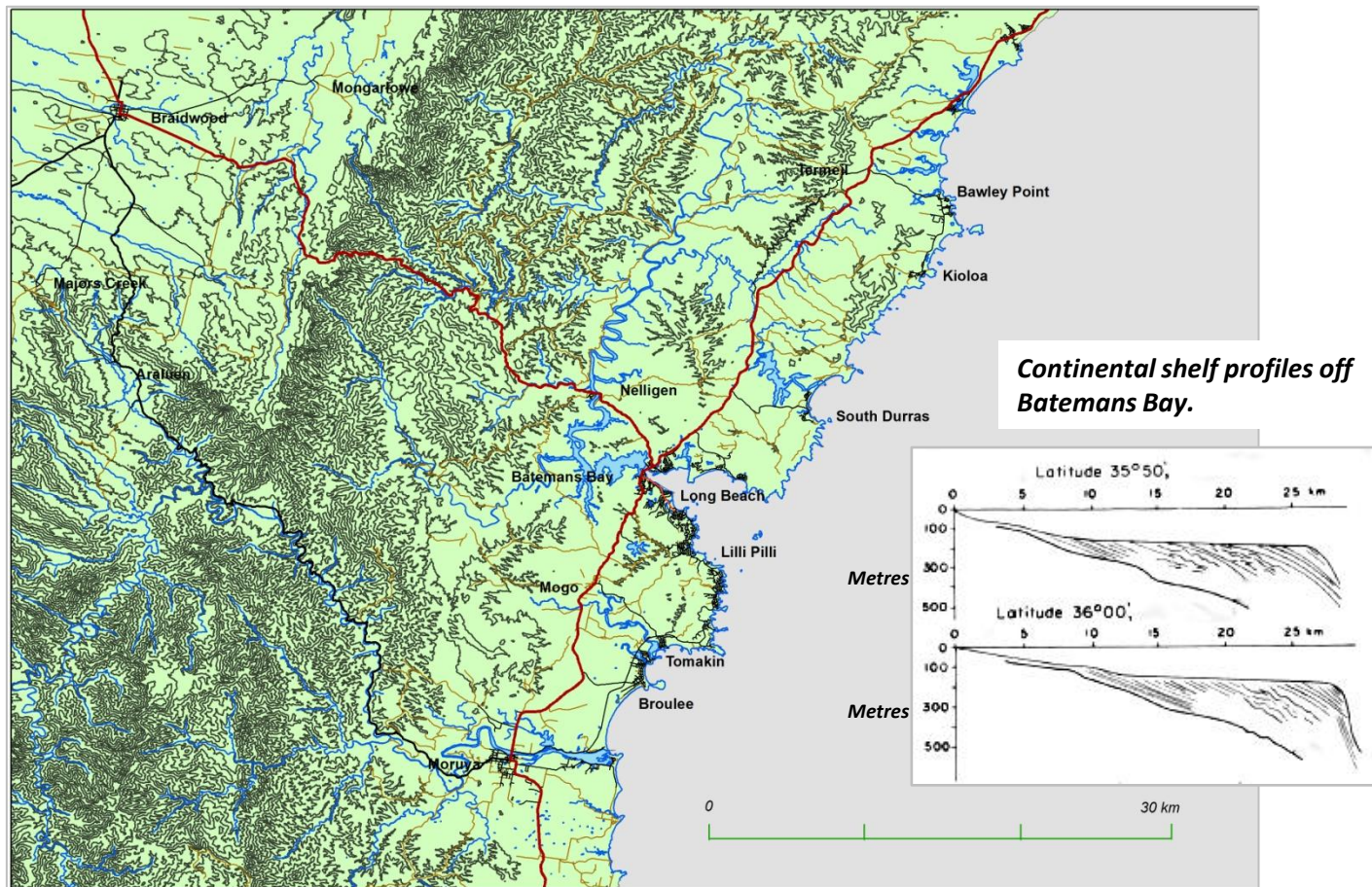
Rock Cycle

Plate tectonic processes inevitably lead to a “recycling” of the Earth’s rocks in various forms as uplift, erosion, deposition, subduction, volcanism, and weathering transport solids in an endless cycle throughout the outer part of the Earth.



Science Teachers Association, UK.

Batemans Bay topography depicted as 100 metre contours.

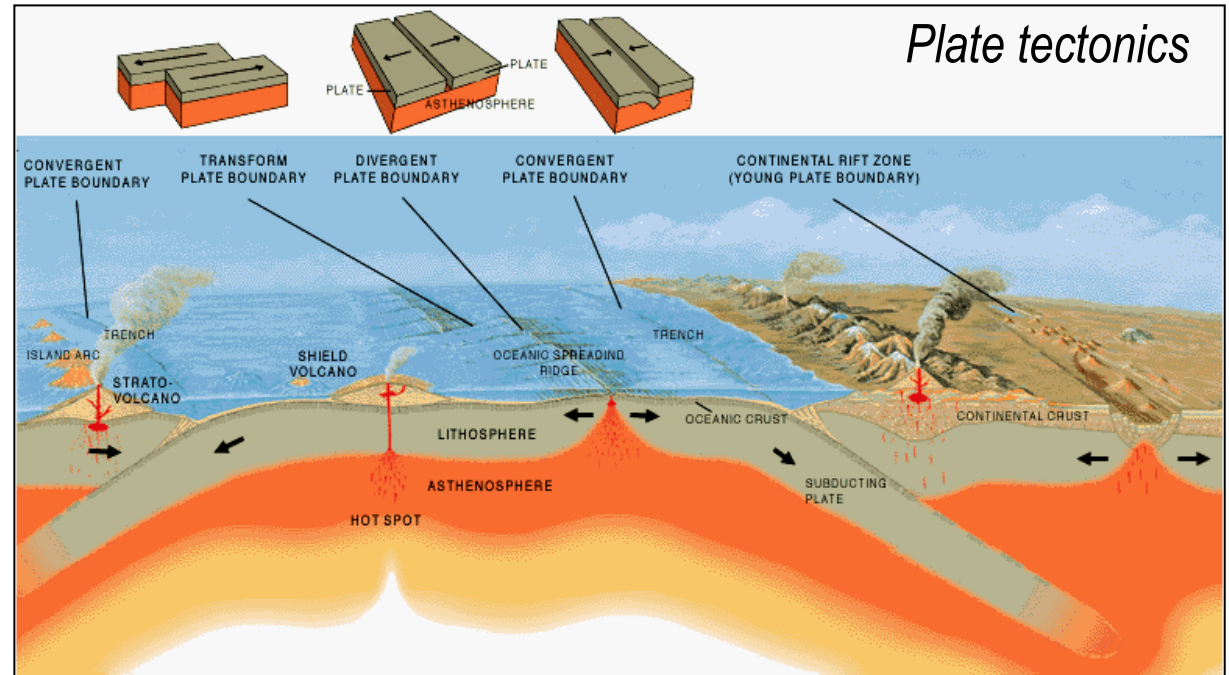


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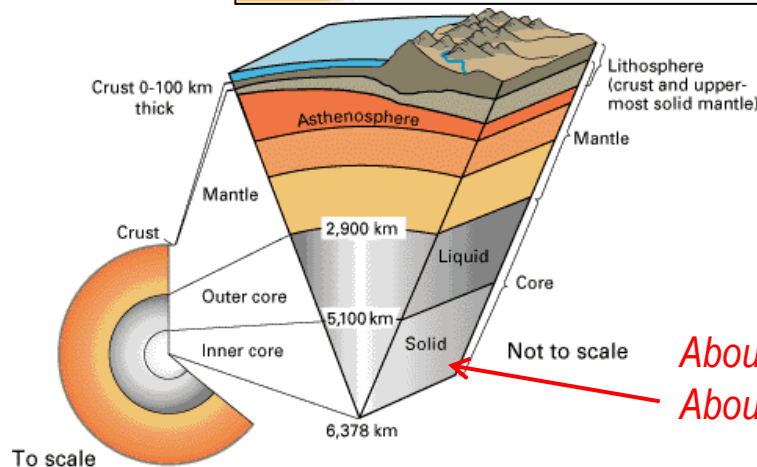
Landscapes

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The Old Courthouse Museum
Batemans Bay NSW



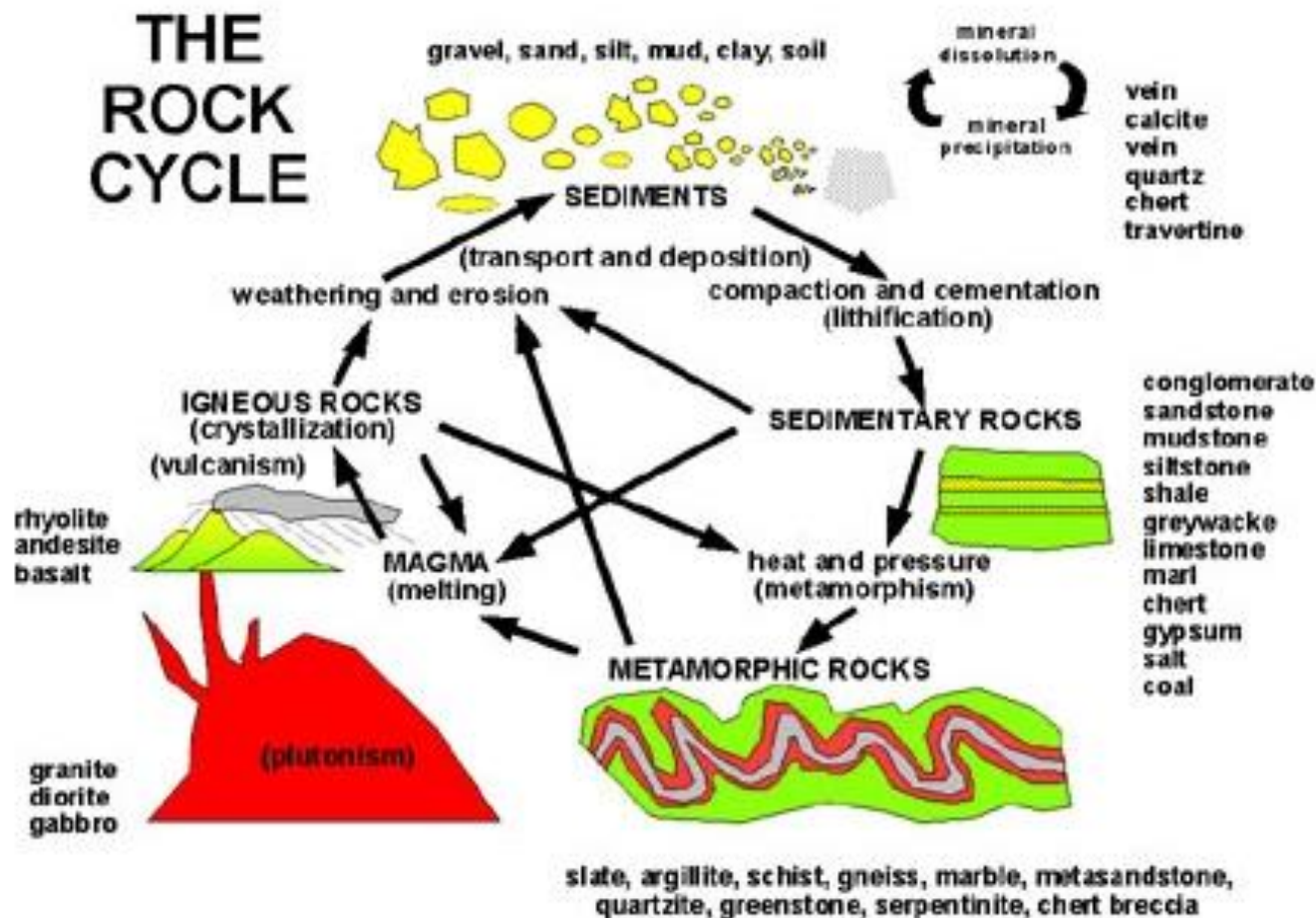
US Geological Survey



Planet Earth is a gigantic
heat engine.

About 6000 degrees centigrade
About 360 GPa., 3.6 million atmospheres

Rock Cycle – many rock types are encountered



Volcanism

Volcanic eruptions can change
landscapes very quickly.

1980 eruption of Mount St. Helens, Oregon, USA

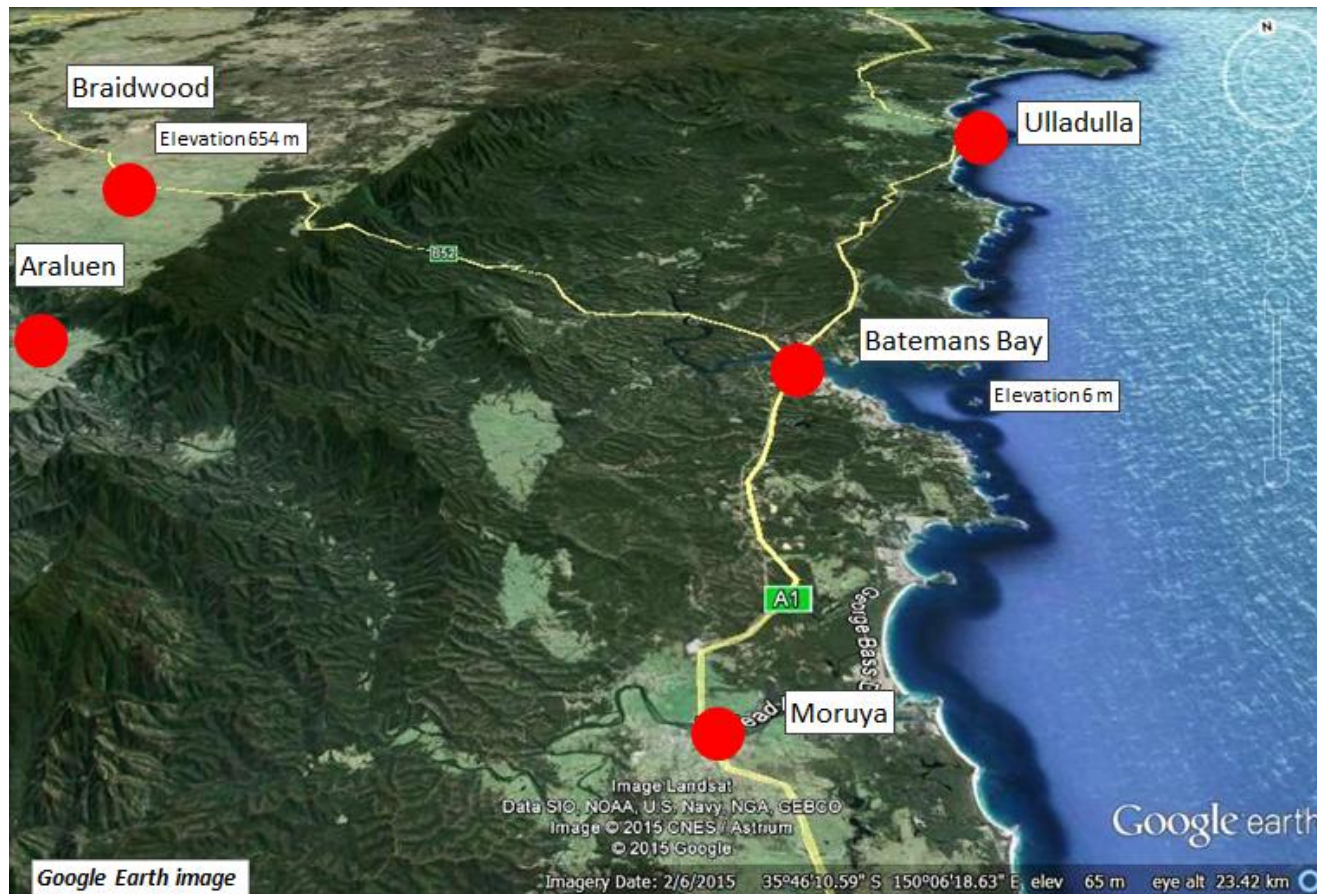


Before



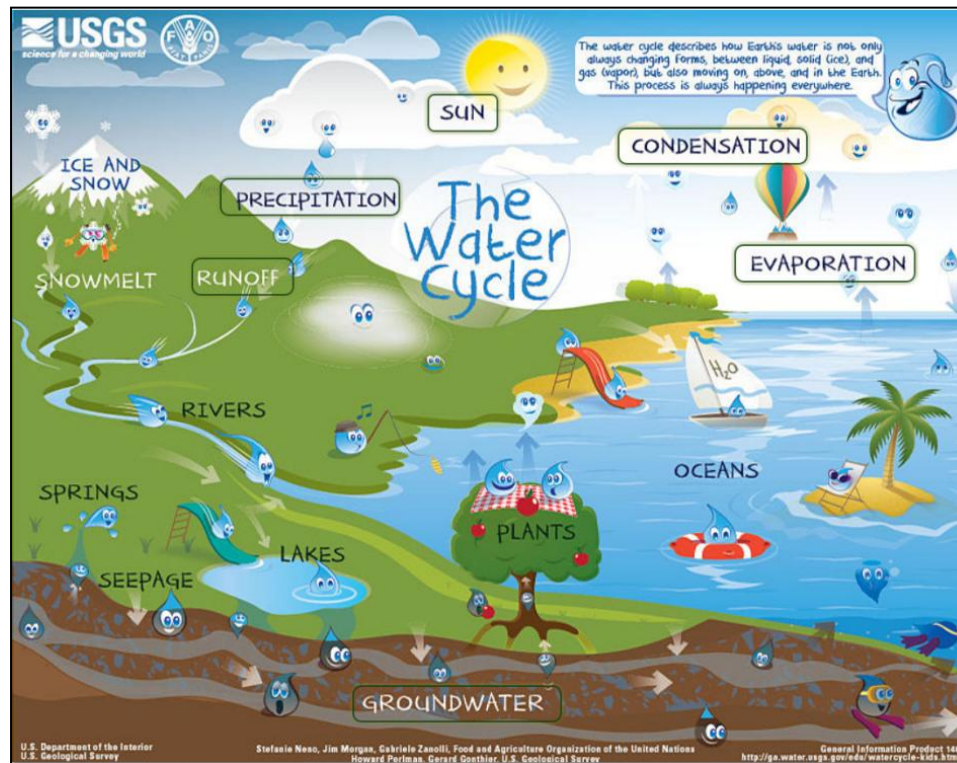
After

Perspective view of Batemans Bay topography.



Water Cycle

Plate tectonic processes lead to uplift at collisional plate boundaries, climate change as plates move from tropical to polar latitudes, and weather changes as mountains and oceans affect water transport.



↑
Uplift

Denudation

↓
Erosion

↓
Sedimentation

US Geological Survey

Eroded landscapes

There are some spectacular examples of eroded landscapes around Australia.



Bungle Bungle Ranges, WA



Pigeon House Mountain, NSW

Erosion rates can change in minutes

Even in southeastern Australia the erosion rates can change quite dramatically in a short space of time. After heavy rain, top soil can be easily stripped from country with poor vegetation cover .

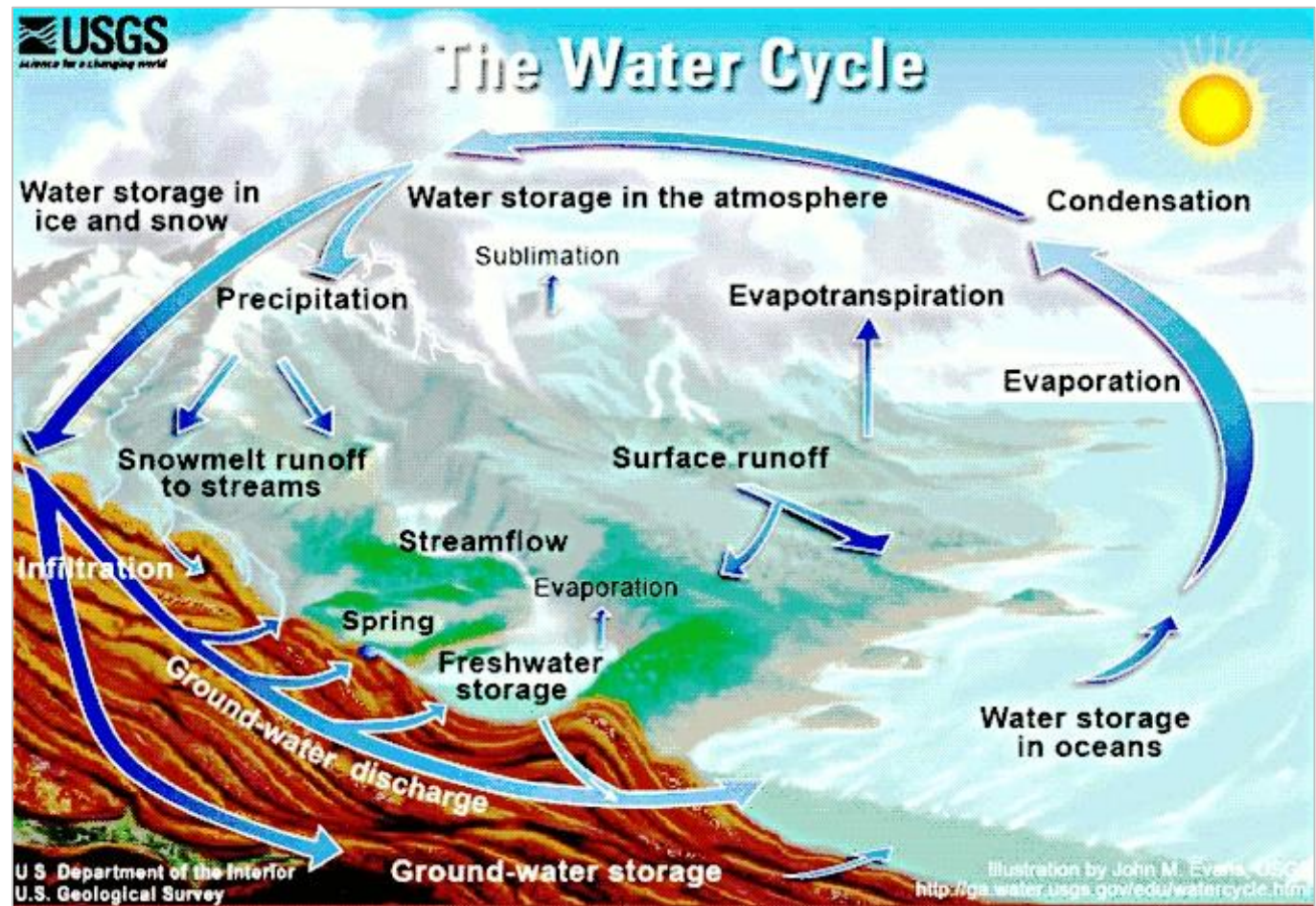


Photo – Doug Finlayson



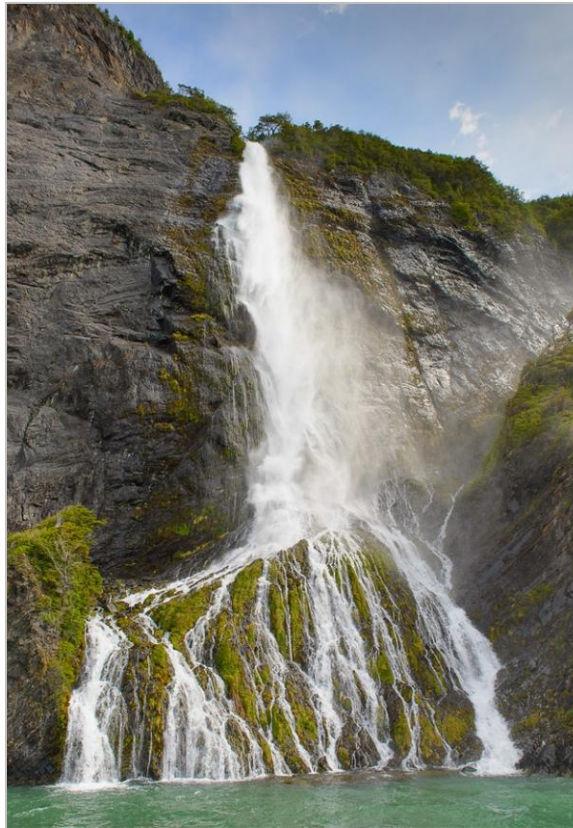
Photo – Tim the Yowie Man

Water Cycle – another useful diagram



US Geological Survey

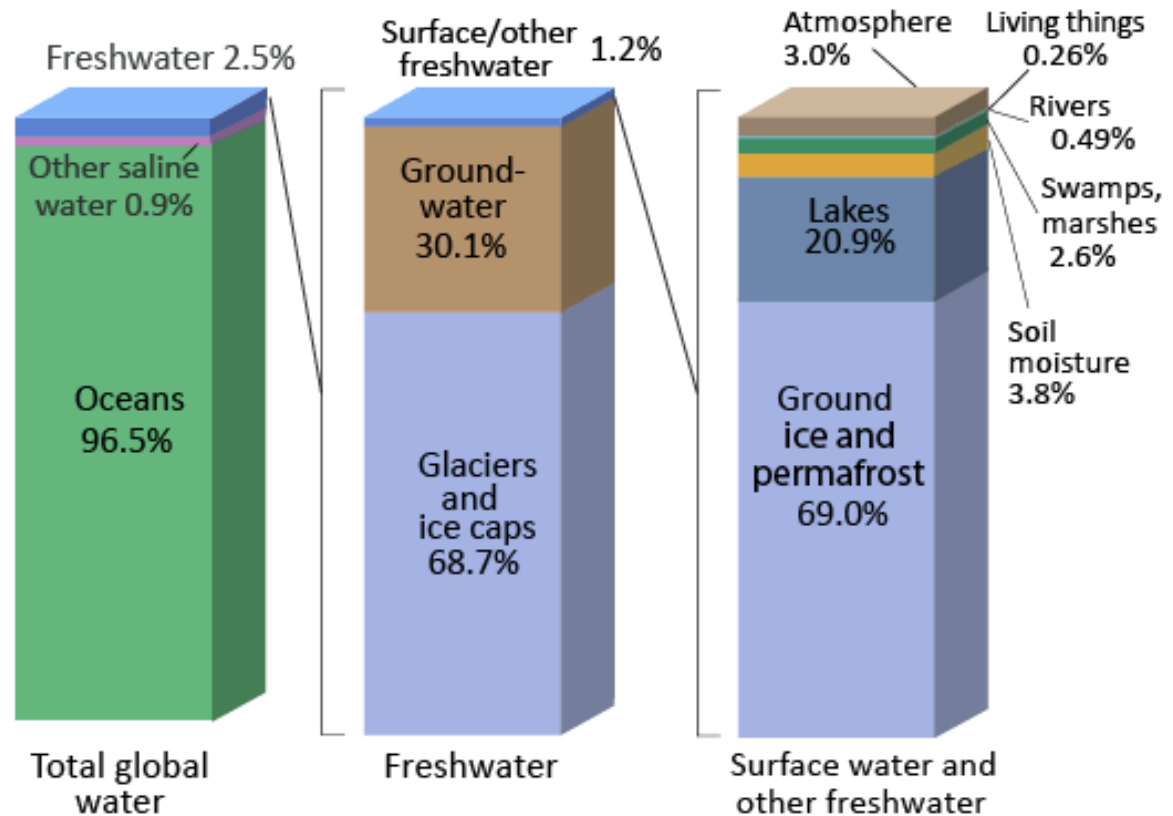
Water Cycle



Patagonia – erosion and sedimentation
Photos – Michael Crerar



Where is the Earth's water?



US Geological Survey

Glaciation

Glaciers at polar latitudes or on high mountain ranges can change landscapes radically.

Gorak Shep near Mt Everest

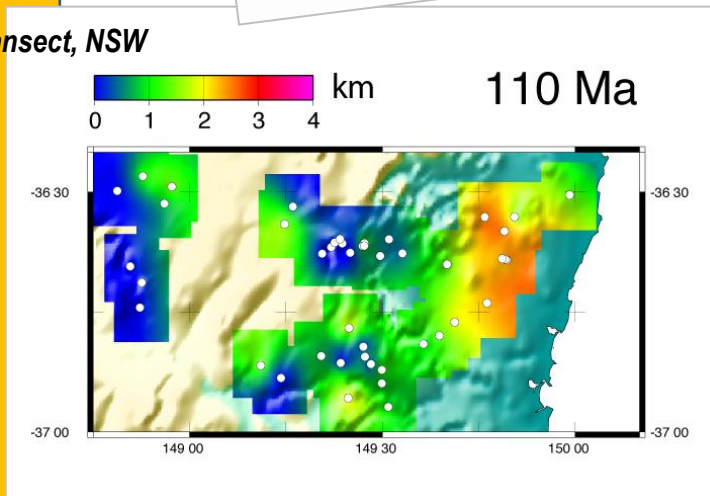


Grey Glacier, Patagonia

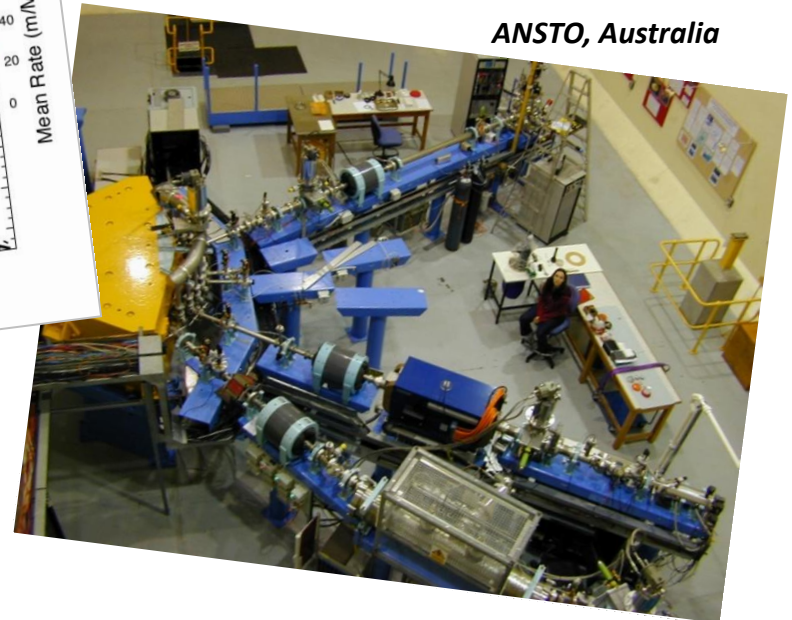
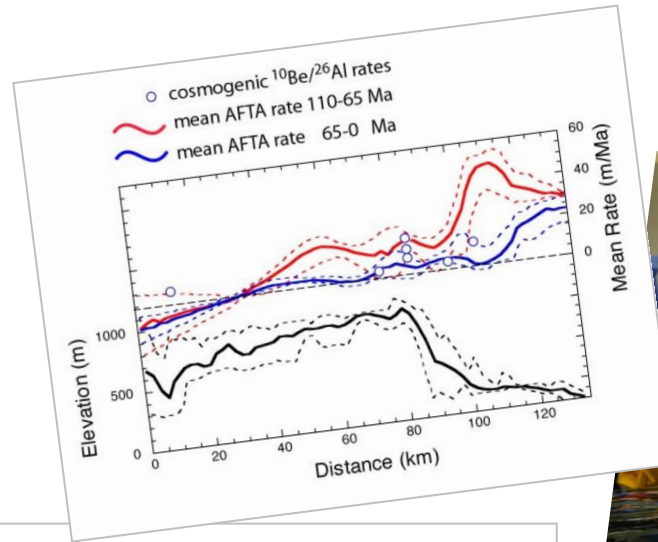


Transarctic Mountains

Brown Mountain transect, NSW



Denudation rates – cosmogenic isotope analysis



ANSTO, Australia

Cosmic rays bombard the Earth and generate isotopes that can determine depth of burial throughout geological time. Hence denudation rates can be calculated.

Cockburn and others, Melb Uni., Edin Uni.

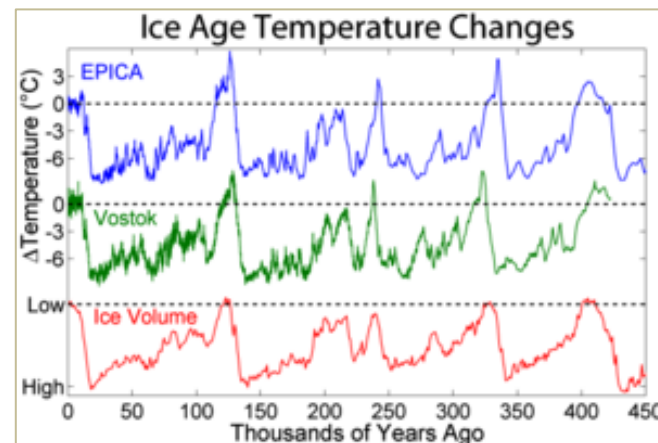
Tectonic events affecting Batemans Bay landscapes

A number of tectonic events have significantly affected the Batemans Bay region topography and landforms (geomorphology). One major event was known as the **Tabberabberan Orogeny**, a compressional folding, faulting and uplift event about 370-380 million years ago that affected the whole of southeastern Australia. The Bega Batholith (including the Braidwood Granite and Moruya Granite) was emplaced at 380-420 million years and would therefore have experienced uplift at the time of the Tabberabberan Orogeny.

The second major event affecting the landscapes around Batemans Bay was **the rifting event that formed the Tasman Sea** about 90-100 million years ago and greatly influenced the topography and cliff lines along the NSW South Coast region that we see today. The tectonics of rifting can include uplift and hence has affected the erosion and drainage patterns for rivers and creeks in the Batemans Bay region right up to the present day.

The last ice age, about 21,000 years ago, the sea level would have been about 120 metres lower than today and the coast would have been about 20 kilometres offshore from the present-day coast and near the edge of the continental shelf. A canyon offshore from the Clyde River extends right down the deep ocean floor of the Tasman Sea at 4500 metres depth.

However, the last ice age is one of many that have affected the region over the last few million years.





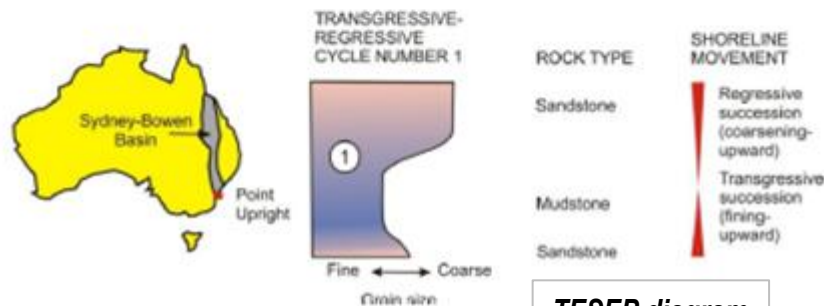
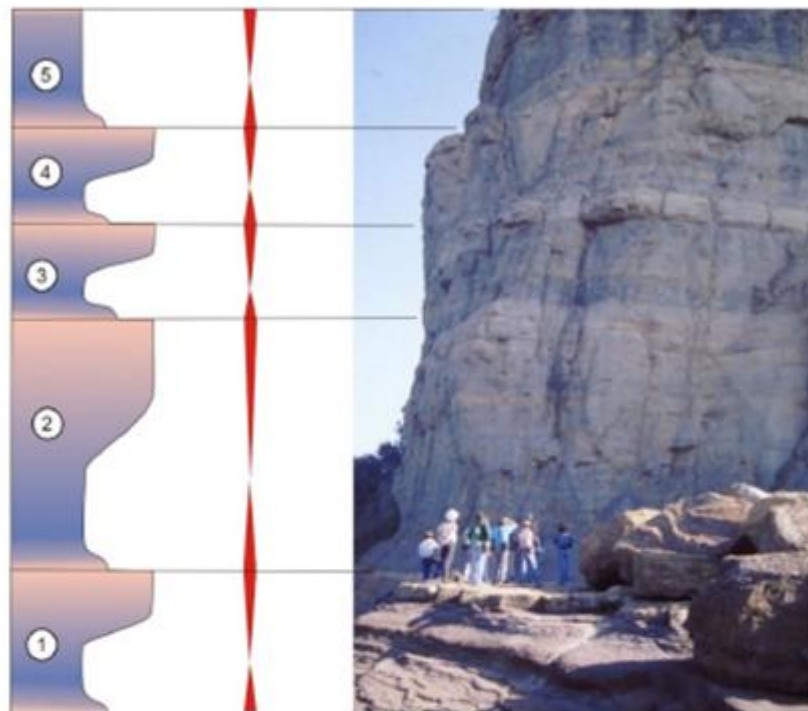
***Geology exposed by Tasman Sea rifting, McKenzies Beach,
south of Batemans Bay.***

Effects of ice age cycles and sea level changes

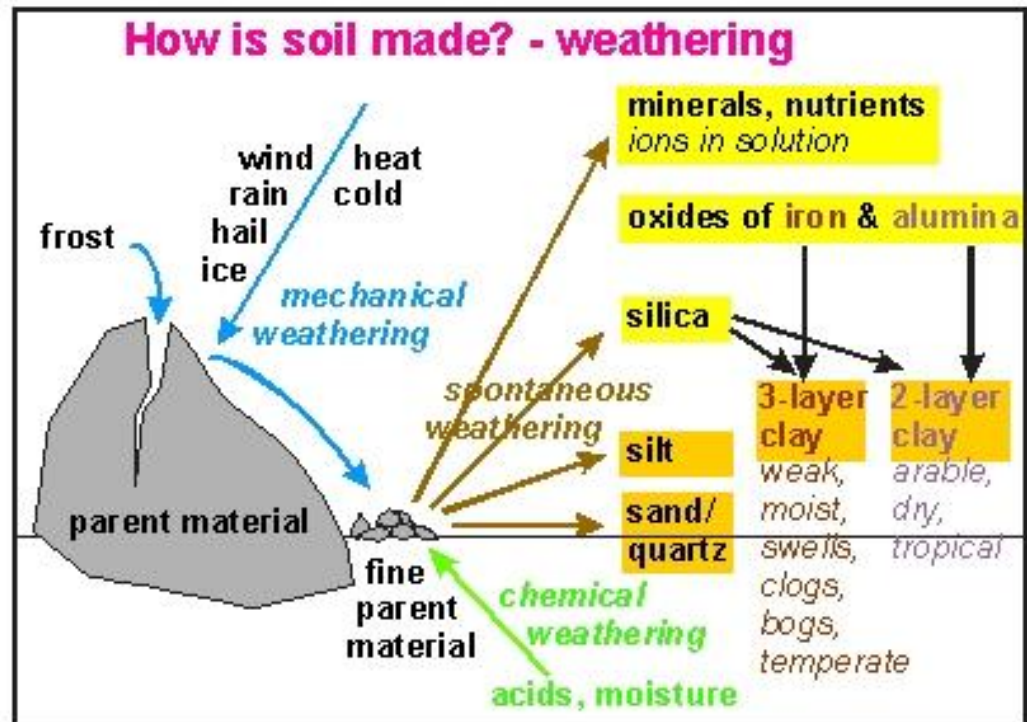
The effects of ice ages and the consequent changes in sea level are seen in the sea cliffs of Sydney Basin sedimentary sequences north of Batemans Bay.

Transgression (sea level rising) and regression (sea level falling) of sediments as sea level change is seen in the mudstone and sandstone sequences identified up the cliff face.

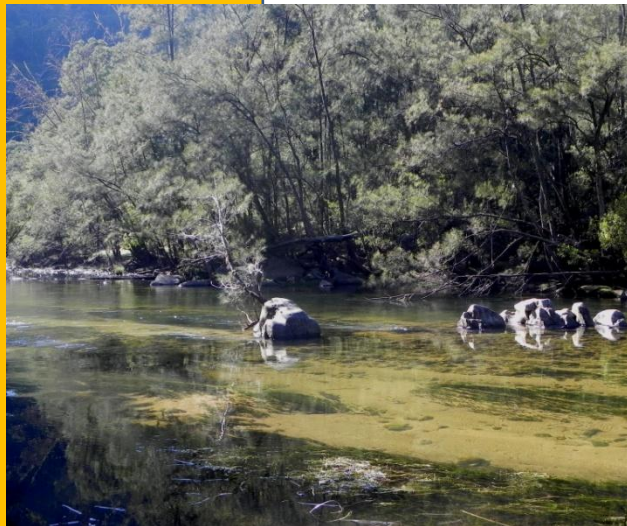
North Durras sea cliffs



Soils result from a combination of different factors



Add in biological
material



*Deua River mixing granite granules, metasediments and
biological components.*



Bells Creek eroding through Braidwood Granodiorite near Araluan.

*There's much more information on web sites and in books and journals.
Some of these are listed below.*

Books and publications

- ***Shaping a Nation: A Geology of Australia*** – Richard Blewett,
Geoscience Australia, 2012.
- ***The Geology of Australia*** – D. Johnson, Cambridge University Press, 2004
- ***Geologica: The origins of the Earth*** – Millenium House, 2007.
- ***Earth: the definitive visual guide*** – Smithsonian Institution, DK Ltd., 2004.

Web sites

- ***<http://www.ga.gov.au/scientific-topics/national-location-information/landforms>***
- ***<http://science.uniserve.edu.au/school/quests/ozlandforms.html>***
- ***[http://www.environment.nsw.gov.au/bioregions/
BioregionsNswoutlineLandscape.htm](http://www.environment.nsw.gov.au/bioregions/BioregionsNswoutlineLandscape.htm)***
- ***<http://www.learner.org/interactives/rockcycle/>***
- ***<http://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle.html>***
- ***<http://water.usgs.gov/edu/watercycle.html>***