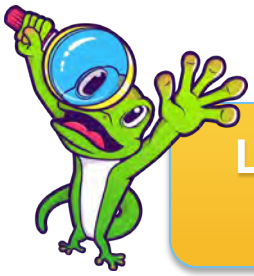
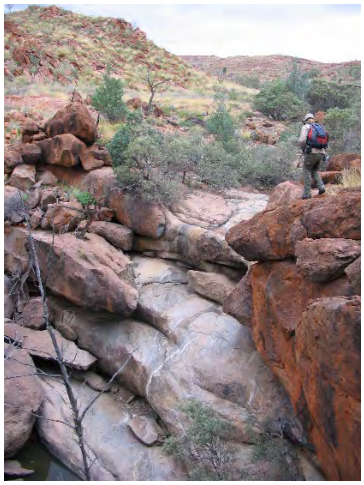


Landscape Changes and Timescale - Teacher's Notes

Landscape Changes and Timescale – Classroom Discussion

During South Australia's geological history there have been massive changes in the landscape.

1. Between 3200 and 1450 million years ago, long episodes of magmatism and mountain building events occurred throughout the northern half of what is now South Australia. These rocks now underlie most of the area between the Eyre Peninsula, the SA/NT/WA border and towards Broken Hill.



1800-million-year-old rocks in the Musgrave Ranges

2. Tectonic plate movement caused the world's continental fragments to all collide 1230 million years ago, forming the supercontinent Rodinia. The supercontinent was stable for a long time, until it started stretching and breaking up approximately 750 million years ago. This created several 500+ km wide basin-shaped sagging depressions that flooded with sea water. Surrounding rivers then filled the basins with eroded sediment. The sedimentary rocks formed in these basins comprise most of the remaining parts of South Australia. Most of the rocks in the Mount Lofty Ranges and the Flinders Ranges belong to these basins. They are studied by geologists worldwide, as they contain geological evidence for the breakup of Rodinia, the two largest global glaciation events and fossils of the earliest recognised animal life, the Ediacara fauna.

600-million-year-old Ediacaran fossil in the Flinders Ranges

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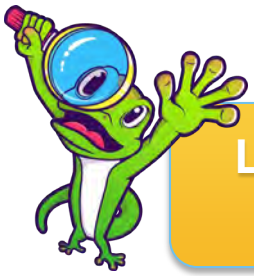


Landscape Changes and Timescale - Teacher's Notes

3. Tectonic plate movement continued, causing Australia to collide with India and Africa 540 million years ago, forming the supercontinent Gondwana. The collision buried, heated and squashed most of the old rocks we see in South Australia today and rearranged much of the state's geology. During this time the Musgrave Ranges (the highest mountain range in SA) were exhumed from beneath a basin in the northwest of the state, in an event that is comparable to what is occurring in the Himalaya today. Magmatism during this time caused igneous intrusions throughout the state, including the granites at Victor Harbour, Mannum and on Kangaroo Island.

500-million-year-old granite near Mannum

4. About 200 million years ago the landmasses that made up Gondwana began to shift and break apart. This culminated with Australia separating from Antarctica 130 million years ago, as Australia drifted northwards, away from the South Pole. Many of South Australia's smaller basins, to the northeast and southeast, formed during this time. The abundant marine life at the time is well represented as fossils in these rocks.

5. Approximately 60 million years ago a large fragment of an old oceanic plate in the mantle below South Australia began sinking. The suction effect of this sinking likely caused both the Lake Eyre Basin as well as the Murray Basin to form. These basins filled with

20-million-year-old limestone along the River Murray

sediment transported by river systems. The Lake Eyre Basin is still sinking today and continues to slowly accumulate sediment. The Murray Basin rocks are visible in cliffs along the Murray River and throughout much of the South East.

6. The continual northward movement of the Indo-Australian tectonic plate has caused South Australia to pass through different climatic zones and changed the distribution of oceanic currents which in turn have altered global weather patterns. Much of inland South Australia experienced high rainfall and was well forested until about 10 million years ago, when rainfalls decreased.

More recently:

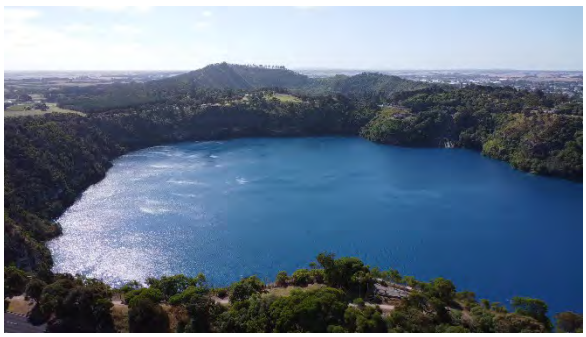
7. A series of glacial and interglacial periods began 2.6 million years ago, bringing about the present climatic regime and causing rapid desertification of inland areas. Sea level changes during this time inundated and exposed large areas of the South East, forming the stranded coast lines visible throughout much of the Murray River – South East region.

Old, stranded coastlines in the South East

8. As recently as 20 000 years ago, South Australia was home to many species of megafauna. Animals such as the Diprotodon (rhinoceros-sized mega-wombat) and the Thunderbird/Dromornis (2.5 m tall ostrich-like goose) lived in forests of soft leaved trees. The climate changed and became drier and harsher. The trees then died and were replaced by hard leaved eucalypts and spinifex started to

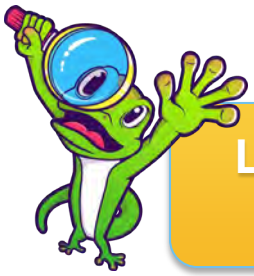
colonise the grasslands. The change in vegetation changed the landscape. The arrival of Aboriginal people with their fire stick farming about 60 000 years ago coincided with the last of these amazing creatures.

9. Several volcanoes erupted in the South East, including Australia's most recent volcanic activity at the now dormant Mount Shank and Mount Gambier, which last erupted 4000 years ago. These eruptions were observed by indigenous groups in the area and stories of the eruptions were passed down through the generations.



The volcanoes at Mount Gambier last erupted 4000 years ago

10. The ranges that formed during past tectonic events continued to erode, changing the distribution of the drainage systems and the height of the mountains. Old fault lines in several ranges experienced reactivation. Movement on the long parallel faults in the Mount Lofty Ranges continues to shape the Adelaide Plains. Movements on these faults are experienced as earthquakes, like the



Landscape Changes and Timescale - Teacher's Notes

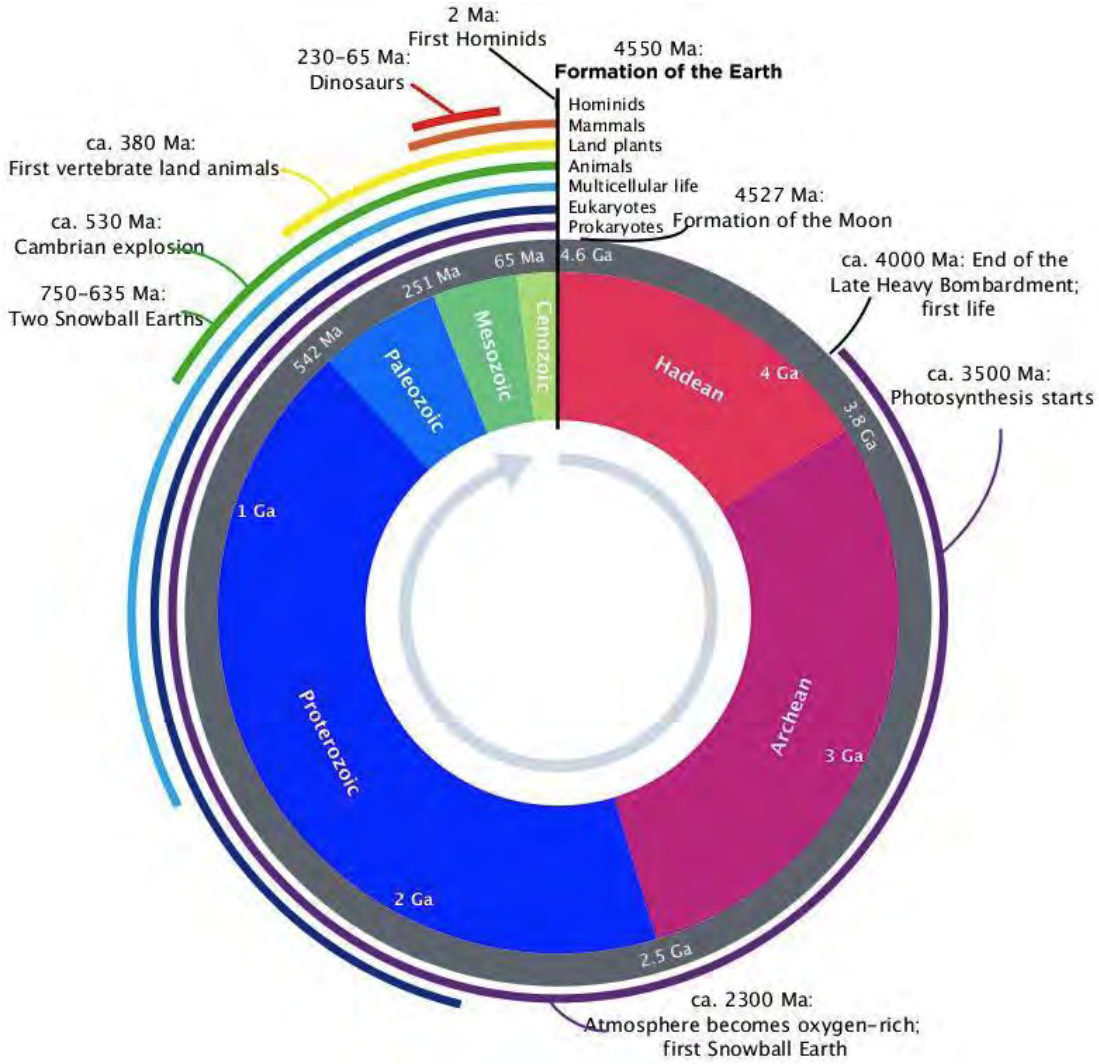
1954 Adelaide earthquake that measured 5.5 on the Richter scale.

11. The arrival of Europeans, with their introduced animals and agricultural practices, have caused significant changes to the landscape. Much of the southern half of the state has been cleared for agricultural purposes and the Adelaide plains is now a highly modified urban environment. Mineral and petroleum resources created during past geological events are now being extracted. There are over 20 active mines in SA (as at 2023) which together account for 40% of the state's exports and consequent tax revenue.

The Adelaide plains continue to be modified today

Our planet formed about 4.6 billion years ago. Natural landscapes have changed greatly over geological time. Indeed, the major geological time units have been named and divided by these major changes in landscape and resultant changes of animal life and plant life. About 66 million years ago massive volcanic outpourings of lava coinciding with a major meteorite impact contributed to the K/T (Cretaceous-Tertiary, otherwise know as the Cretaceous-Paleogene) extinction event that caused the death of 75% of animals on Earth including the dinosaurs. All life on our planet at present evolved from the survivors. After this, the great supercontinent of Gondwana broke up releasing the Australian tectonic plate to travel past the South Pole and to its present position. The different climatic zones it travelled through created different landscapes.

Landscape Changes and Timescale - Teacher's Notes



Natural landscapes and features are those that have only been slightly affected by humans. It is difficult to find truly natural landscapes in South Australia as most accessible areas have roads.

Managed landscapes have been partly modified by humans to suit their purposes. Farming land and parkland are reasonable examples.

Constructed landscapes have been built by humans.

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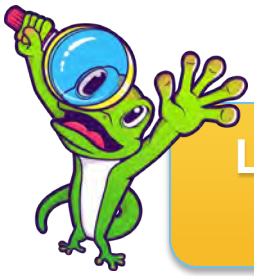

Landscape Changes and Timescale - Teacher's Notes

Landscapes – Student Activity (with pictures)

Changes in **natural features** in a landscape are created by:

- Long term geological activity
- Shorter term weathering agents such as rain, wind, flowing water, ice and heat from the Sun
- Long and short term changes in climate

Mt Schank, a dormant volcano in the southeast of SA last erupted 4000 years ago

Natural landscape features are those that generally existed before the advent of humans and still exist now. These tend to be geographic features such as mountains, rivers, plains, volcanoes, oceans, beaches and forests.

Managed features are those with changes **made by humans** to natural features so that they can more easily access and control Earth's resources, such as pathways in national parks, toilets in nature reserves, grassed playing fields in schools and drainage channels across areas liable to flood. Managed features can also be seen where one type of vegetation has been replaced by another, such as when a woodland forest has been replaced by a pine plantation or when one kind of animal is replaced by another, such as cattle grazing where kangaroos and emus used to.

Vineyards and other agriculture below the partly cleared Sellicks Hill, south of Adelaide

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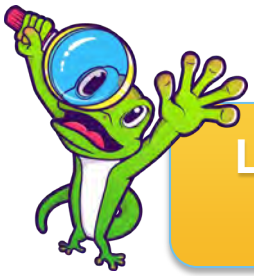

Landscape Changes and Timescale - Teacher's Notes

City with roads, buildings and non-native vegetation

Constructed features are built by people such as houses, schools, roads, railways, airports, dams, irrigation ditches, sewers, power stations, mines and ports.

Materials

- 12 or more laminated pictures of different landscapes or upload the photographs included in this package onto a Smart Board.
- 4 different coloured non-permanent felt tip pens (or markers for the Smart Board).

Method

These pictures may be expanded, printed and laminated so a student or group can mark them with water-soluble felt pens to highlight the location of any built features and natural features.

If the pictures are printed and laminated then they can be cleaned and used in subsequent years. Students are issued with a picture and should then give three good reasons why their picture is of a natural, managed or constructed landscape. They both identify and describe the features in the picture.

Extension

Take your students for a walk round your local environment and ask them to identify the natural, managed and constructed features.

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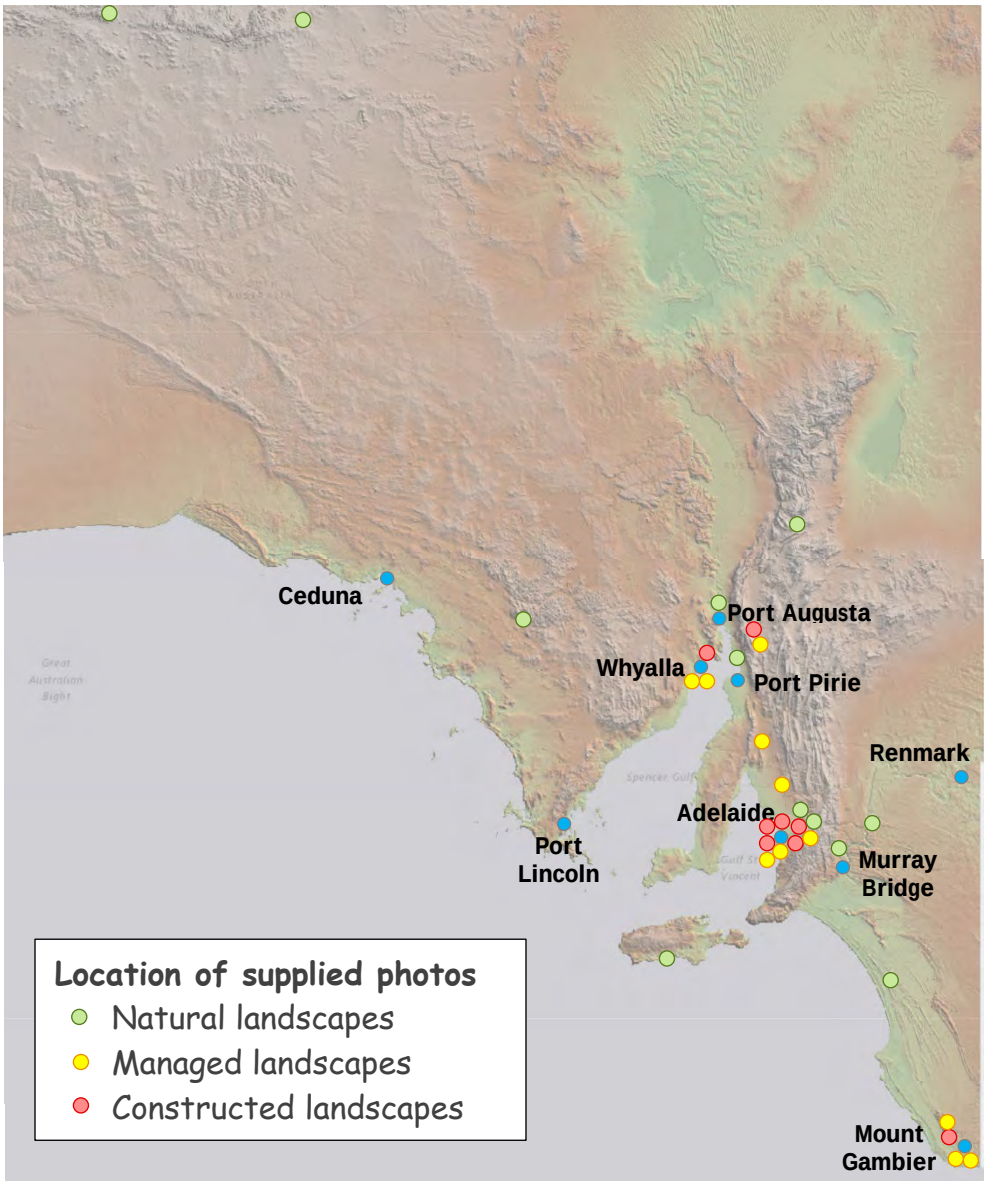
Location of supplied photos



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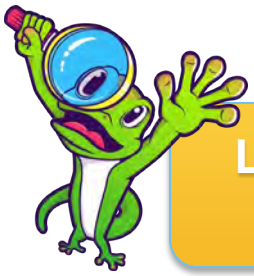


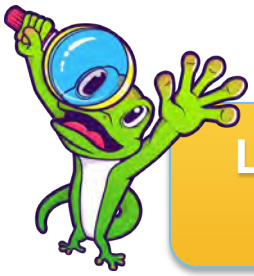
Landscape Changes and Timescale - Teacher's Notes

Aboriginal Dreamtime – Classroom Discussion

Some Aboriginal cultures believe that the Universe, including the Earth and all its people was created by a giant rainbow serpent (called Wanampi in some parts of South Australia and the Northern Territory). The rainbow serpent then shaped the landscape where its body moved over the unformed land. It pushed up mountains and created valleys where it moved over the land. Spots where it stopped to rest at night later became good meeting places for Aboriginal groups. Where its body had squirmed, it left low hollows away from the wind where good water collected. It eventually returned to the sky where it watches down on people making sure they care for country. There are many depictions of this being in Australian rock art and paintings.

Rock shelters throughout Northern Territory are often marked with a snake image.

In the Dreamtime stories from country that lie north and inland from Kalgoorlie, a similar serpent is said to be responsible for chewing Gnamma holes out of the rock. These collect and store freshwater after rain. Aboriginal people would cover them with more



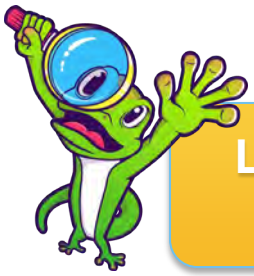
Landscape Changes and Timescale - Teacher's Notes

rock or brush to stop animals contaminating them and defended them as a precious resource in hard country. This gnamma hole (above) at Barlangi rock near Sandstone has lost its cap and has filled in. It is over 1m deep.

Concentric circles carved into rock or painted onto rock often mark the location of good water (perhaps the petroglyph represented circular ripples spreading from a stone dropped into water). Groups would fight over water resources and the game, which collected round them. The rock on the right is near Puunu waterhole near Mt Newman (WA) but similar engravings are found in the Flinders Ranges.

Aboriginal people believed that the landscape was created in the Dreamtime before the world, as we know it, began.

Geologists and geographers believe that earth forces such as weathering, erosion, mountain building, faulting and other tectonic forces are continually shaping and reshaping the surface of our planet.



Landscape Changes and Timescale - Teacher's Notes

Sandpit Science – Classroom Discussion

Raindrops quickly change the shape of unconsolidated material but have little short-term effect on rocks. Ideally the sandpit should be bordered by rock. If not, please have a few pieces of rock (road gravel) or concrete handy.

If you do not have plastic droppers like Pasteur pipettes, a straw can be used. The straw is held vertically and half immersed in water. A finger is used to seal the upper opening of the straw and it can be raised out of the water still retaining water. It can be taken (still sealed by the finger) to where it is needed and water drops "milked" out by the other hand.

Materials

- Sandpit and rocks (or cement).
- Hands, buckets & spades.
- Four containers of water (ice cream containers are ideal).
- A straw or a Pasteur pipette for each student.

Method

1. Take students to sandpit and ask them to quickly landscape the sand into mountains.
2. Demonstrate to the students how to use the straw to make a water dropper.
3. Drop 30 raindrops on one part of their mountain landscape and observe any changes.
4. Repeat dropping all the water at once on another part of the mountain range to represent the flow of a river.
5. Repeat the last two activities to see the effect of rain and a river on the rock.

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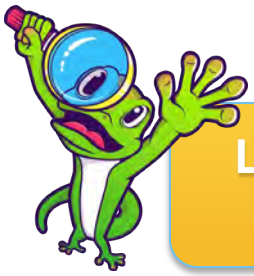

Landscape Changes and Timescale - Teacher's Notes

Questions for discussion

1. Does rain have a short-term effect on soil and sand? Yes.
2. Does rain have a short-term effect on rock? No

Over millions of years rain and running water and others forms of weathering and erosion eventually wears away mountains.

Suggested Activities
Dick Roughsey's book - The Rainbow Serpent
This beautifully illustrated book explains how our landscape was formed and how rainbow lorikeets got their colours.
Students may wish to draw or paint the serpent.
Local elders may be invited to discuss the importance of country and of local landscape features.