THE AUSTRALIAN PLATE

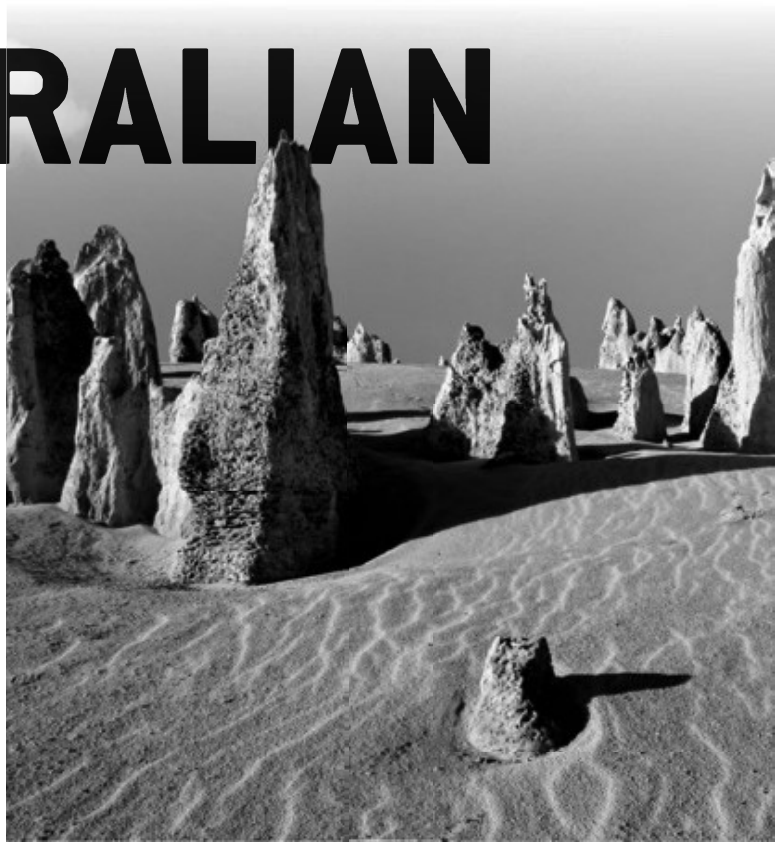
Australia is a very old continent. It is far from plate boundaries and fault lines, so it is more stable than some other parts of the world. But volcanoes happened here in the past, and earthquakes still happen in Australia.

Old Australia

The oldest minerals in the world are located in Western Australia. Scientists have discovered rare grains of sand called zircon that formed more than 4 billion years ago. Some of the oldest soils in the world are found across large parts of Western Australia, which has not been covered by sea for more than 2.5 billion years.

Some areas at the surface of Victoria and Queensland are geologically much younger because they were formed by more recent volcanic eruptions.

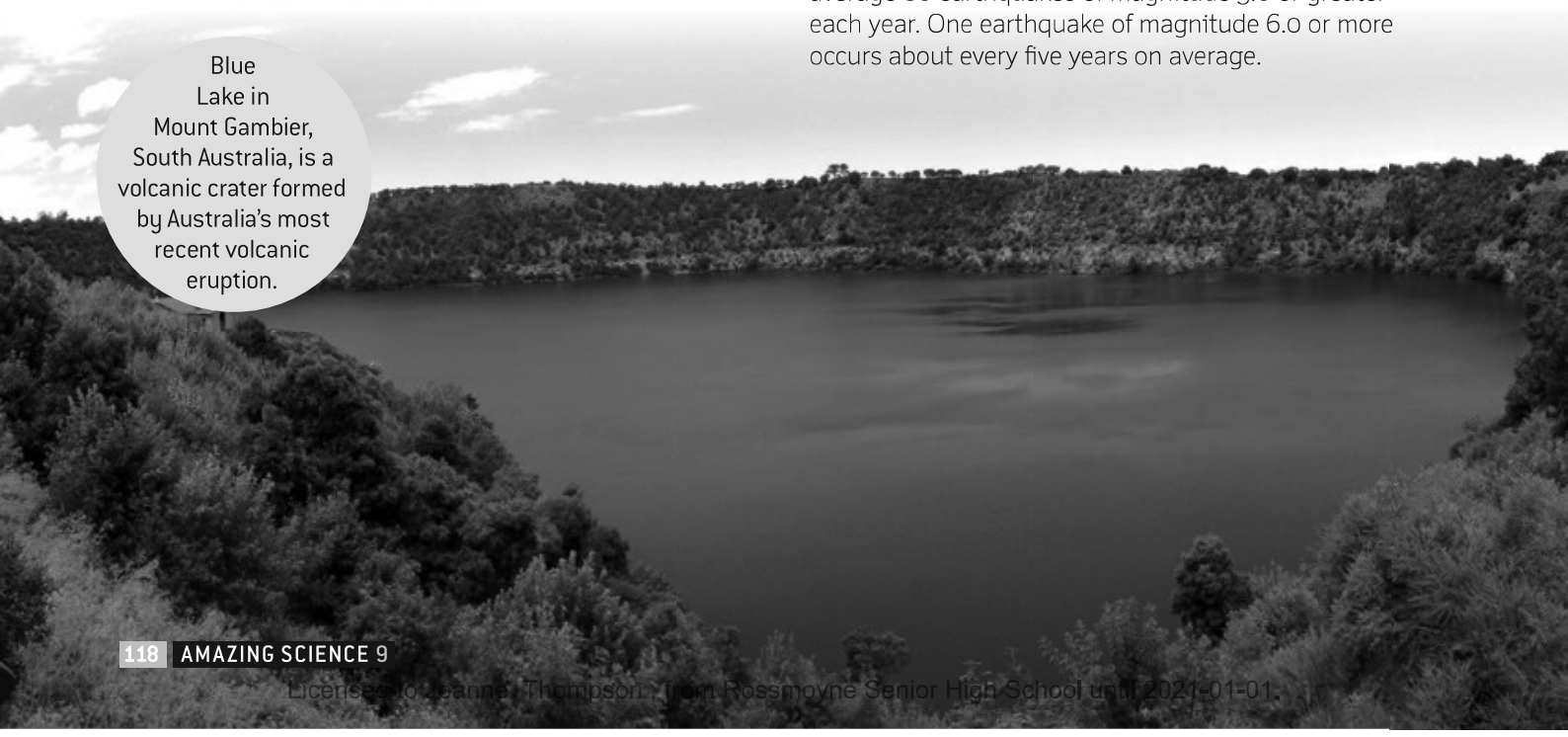
Australia formed as a separate continent when it broke away from Gondwana almost 100 million years ago. It has been isolated from other continents for a very long time, so unique animals and plants have developed here. Many plants and animals in Australia are found nowhere else in the world.



The oldest rocks and soils on Earth are found in the west of Australia. The Pinnacles are limestone formations, located north of Perth in Western Australia.

Australian earthquakes

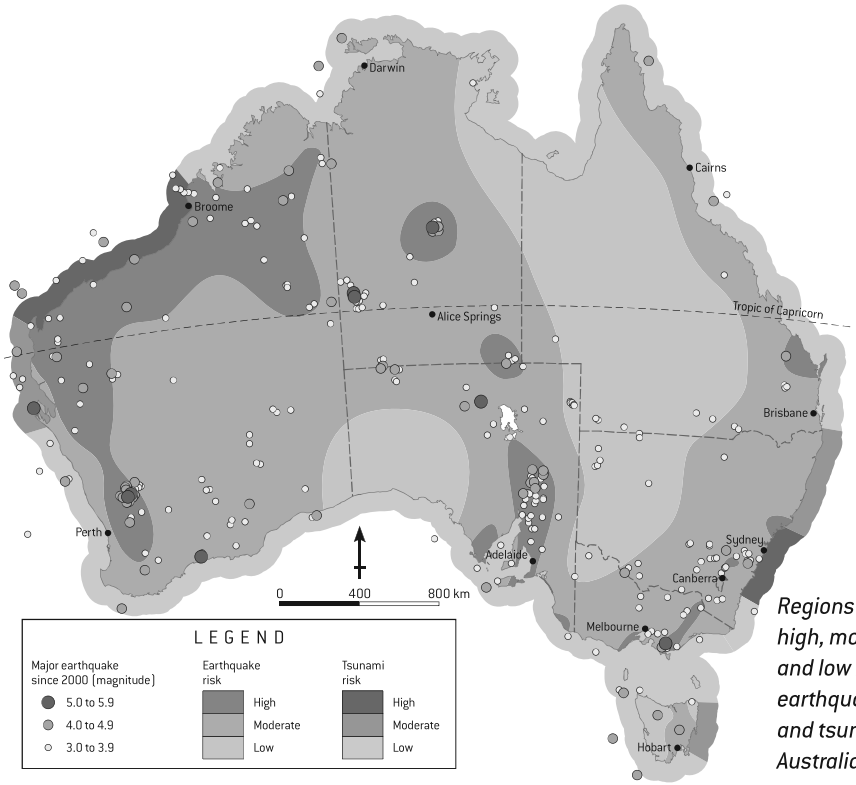
The Australian continent sits near the centre of a plate, where tectonic activity occurs less than at plate boundaries. Nonetheless, in Australia there are on average 80 earthquakes of magnitude 3.0 or greater each year. One earthquake of magnitude 6.0 or more occurs about every five years on average.



Blue Lake in Mount Gambier, South Australia, is a volcanic crater formed by Australia's most recent volcanic eruption.

Australian earthquakes occur due to the Australian plate moving towards the Eurasian, Philippine and Pacific plates. Forces at the tectonic plate boundaries create stresses across the Australian plate that, when released, causes earthquakes.

The largest earthquake ever measured in Australia was of magnitude 7.2. It occurred in 1941 at Meeberrie, Western Australia. Thankfully this is a remote and sparsely populated area so no lives were lost, but the walls of a local homestead were damaged, rainwater tanks burst and the ground cracked.



Regions of high, moderate and low risk for earthquakes and tsunamis in Australia.

Our volcanic past

Volcanoes erupted along Australia's east coast around 45 million years ago as Australia moved north after separating from Antarctica. The plate moved over a **volcanic hotspot** in the mantle. This means southern areas of the northward-moving continent experienced volcanic activity more recently.

There are several hundred volcanoes in south-western Victoria and south-eastern South Australia that were active until relatively recently. Today, many are considered dormant rather than extinct.

Tower Hill, near Warrnambool in western Victoria, erupted 23 000–33 000 years ago. Red Rock, near Colac in western Victoria, erupted 7800–15 200 years ago. The youngest volcano on the Australian continent is Mount Gambier in South Australia. It last erupted 4000–6000 years ago.

Active volcanoes in the regions surrounding Australia can cause disruption. In June 2011, many airports in Australia had to be closed due to the Chilean volcano, Puyehue. The millions of tonnes of ash, sand and **pumice** stones it erupted into the sky caused an ash cloud stretching from Argentina to Australia. Volcanic ash can cause jet engines to stop, so aircraft in Australia were grounded.

*The Glasshouse Mountains near Brisbane, Queensland, have spectacular rock formations. They are the remains of **lava plugs** from a volcano that erupted 25–34 million years ago.*

LOOK IT UP

lava plug a landform created by magma solidifying in a volcanic crater
pumice a light, porous volcanic rock used in cleaning or polishing
volcanic hotspot an area of increased volcanic activity

CHECK IT OUT

1 Are either of the following statements true?
   a Australia experiences many earthquakes every year.
   b Australia experiences many volcanic eruptions every year.
2 Where are the world's oldest minerals located?
3 Where did a volcano erupt most recently in Australia?
4 Explain why many plants and animals are found only in Australia?
5 Considering the northward movement of the Australian plate, explain why volcanoes in the south of the country are younger than volcanoes in the north.

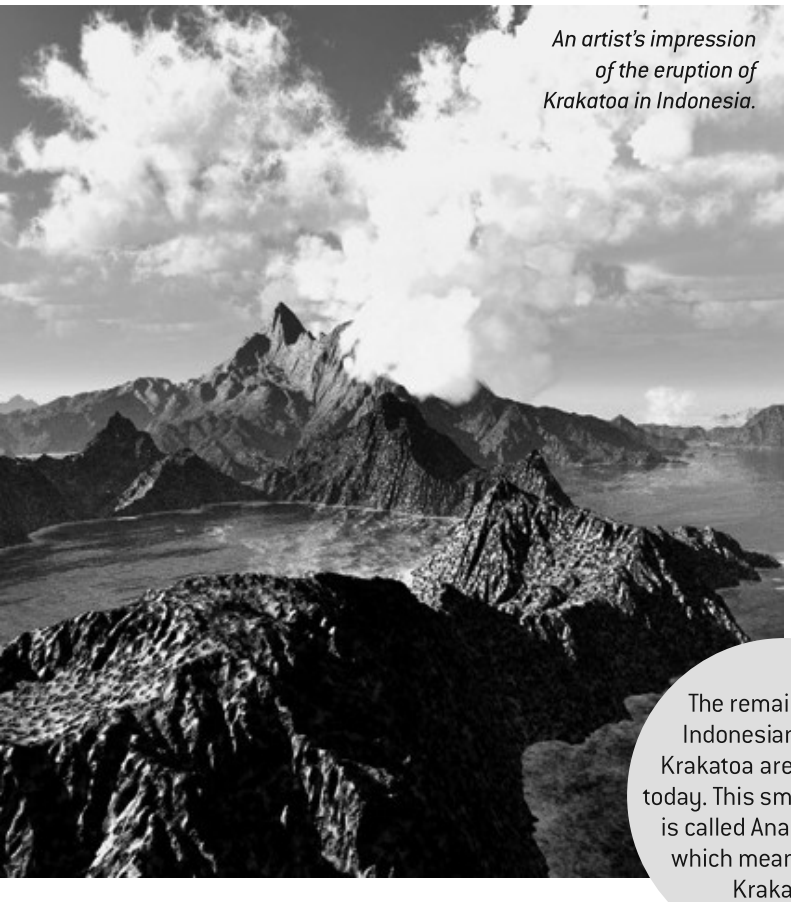
5 DEADLY DISASTERS

1 Krakatoa volcano

The 1883 volcanic eruption of Krakatoa in Indonesia was one of the deadliest and most destructive eruptions ever recorded. More than 36 000 people were killed by the eruption and ensuing tsunamis. Explosions collapsed most of the island and only a third of it remains today.

The eruption was probably the loudest sound ever heard in recorded history. People heard the main eruption 5000 kilometres away, including in Perth and Alice Springs. Barometers around the world measured the shock wave of the final explosion for days.

The ash distributed around the upper atmosphere reflected away sunlight, lowering the global temperature by more than a degree for the following year.



An artist's impression of the eruption of Krakatoa in Indonesia.

Some of the damage following the April 2015 Nepal earthquake.

2 The Nepal earthquakes

Nepal experienced a series of deadly and damaging earthquakes in 2015. They were caused by a release of built-up stress where the Indian plate converges with the Eurasian plate, pushing up the Himalayas.

A magnitude 7.8 earthquake occurred 80 kilometres north-west of the Nepalese capital of Kathmandu on 25 April 2015. It was Nepal's strongest earthquake in more than 80 years. More than 8000 people were killed and 19 000 injured. The earthquake caused an avalanche that killed 19 people on the world's highest mountain, Mount Everest. About 100 people were also killed in neighbouring China, India and Bangladesh.

Two weeks later, on 12 May, a magnitude 7.3 earthquake (one of many aftershocks) occurred between Kathmandu and Mount Everest. This killed more than 125 people and injured more than 2500.

The earthquakes caused $5 billion worth of damage, and the death toll of the combined disaster was the highest in the country's history.

The remains of the Indonesian volcano Krakatoa are still active today. This smaller volcano is called Anak Krakatoa, which means 'child of Krakatoa'.

Damage in Thailand following the 2004 Indian Ocean tsunami.

3 Boxing Day tsunami

On the morning of Boxing Day 2004, an earthquake of magnitude 9.0 struck the ocean floor off Sumatra, Indonesia. The seafloor rose several metres, causing a tsunami to speed towards countries around the Indian Ocean.

Waves up to 15 metres high struck coastlines in many countries, killing about 300 000 people. It is the deadliest tsunami in recorded history and one of the world's worst disasters ever.

4 Pompeii

Mount Vesuvius near Naples, Italy, erupted in 79 CE. The Ancient Roman city of Pompeii was buried beneath metres of hot ash and pumice. The city was discovered 1500 years later, preserved beneath the ground.

It is estimated that 16 000 people were killed by the heat of the eruption, suffocated by the hot ash or crushed by rocks or collapsing buildings. It is the third-highest death toll due to a volcanic eruption, surpassed only by Krakatoa and Mount Tambora.

Mount Vesuvius is still active today. The last eruption was in 1944, destroying several nearby towns.

The eruption of Mount Vesuvius in 79 CE covered residents of Pompeii in hot ash and volcanic rock. Their remains were found centuries later, showing the positions they were buried in.

5 Newcastle earthquake

Australia has dozens of small earthquakes each year, and about every two years an earthquake above magnitude 5.5 shakes the country.

The magnitude 5.6 earthquake in Newcastle, New South Wales, in December 1989, was one of Australia's worst natural disasters. More than 160 people were injured and 13 people were killed. The earthquake damaged more than 35 000 homes, 147 schools and 3000 other buildings. The estimated damage bill was $4 billion.

The earthquake occurred about 11 kilometres below the surface, with the epicentre about 15 kilometres south of the Newcastle city centre. It was felt hundreds of kilometres away.

CHECK IT OUT

1. In what year did the volcano Krakatoa erupt?
2. Are the volcanoes Krakatoa and Vesuvius active, dormant or extinct?
3. What was the magnitude of the earthquake that damaged Newcastle, NSW, in 1989?
4. If Mount Vesuvius experienced a major eruption today, would the death toll likely be greater or less than the death toll in 79 CE? Consider changes in population and warning systems.
5. Explain the factors that you think contributed to the 2004 Boxing Day tsunami being the world's deadliest tsunami.