

WELCOME TO AUSTRALIA – ONE OF THE BIGGEST, FLATTEST, DRIEST AND MOST INHOSPITABLE PLACES ON EARTH. PRESENTED LIKE THIS IT DOESN'T SOUND LIKE MUCH, YET IT'S TRULY ONE OF THE MOST REMARKABLE PLACES IN THE WORLD. DON'T EXPECT ITS SPECIAL QUALITIES TO LEAP OUT – YOU NEED TO LOOK AT IT IN A SPECIAL WAY.

# AUSTRALIA

by David Salt

## – an ancient legacy

An American tourist who had just walked to the top of Mount Kosciuszko was overheard saying "It's not very big, is it? Back home the scenery is so much grander." Indeed, at 2228 metres high, Mount Kosciuszko, our tallest mountain, wouldn't even rate as a major hill in some countries. Is Australia really that uninspiring?

Our mountains aren't big and our canyons don't really rate among the world's deepest or most panoramic.

In fact, Australia is the flattest of all the continents. Its average elevation is less than 300 metres, compared with the world's mean of about 700 metres.

Our snowfields aren't extensive, and we don't have vast areas of rainforest. There is a big red rock in the centre of the continent that's worth a look, but to get to it takes a lot of travelling. Australia's a big place (7,682,300 square kilometres makes it the world's sixth largest country in area).

Our unique wildlife doesn't appear to have the capacity to hurt a fly (no lions and tigers), and our wildflowers are dowdy and small compared to their overseas counterparts.

After Antarctica, Australia has the lowest precipitation of any continent, with a mean annual rainfall of 465 millimetres. Vast areas are arid or semi-desert, therefore unsuitable for settlement.

To really appreciate its special nature you need to understand what you're looking at. It is home to some of nature's most majestic landforms

and one of the most peculiar assemblages of plants and animals you'll find anywhere. Once you understand the character of this treasure, it quickly becomes apparent that we also have a responsibility to look after it. If we don't, it could be lost forever.

### The living continent

Dorothea Mackellar eloquently describes Australia in her poem 'My Country', as "a sunburnt country, a land of sweeping plains, of ragged mountain ranges, of droughts and flooding rains."

Taking this into account you might expect life to be limited on this island continent. And yet, the opposite is true — Australia's living heritage is one of the richest on the planet. What makes our biota so fascinating and precious is that the majority of species found in Australia are unique. How did this come about?

The key lies in its island isolation and geological stability. Whereas the

Sunset over the sand dunes in the Simpson desert.

Bill van Aken, CSIRO Land and Water

Australia's living heritage is one of the richest on the planet.



Australia's highest point, Mt Kosciuszko.

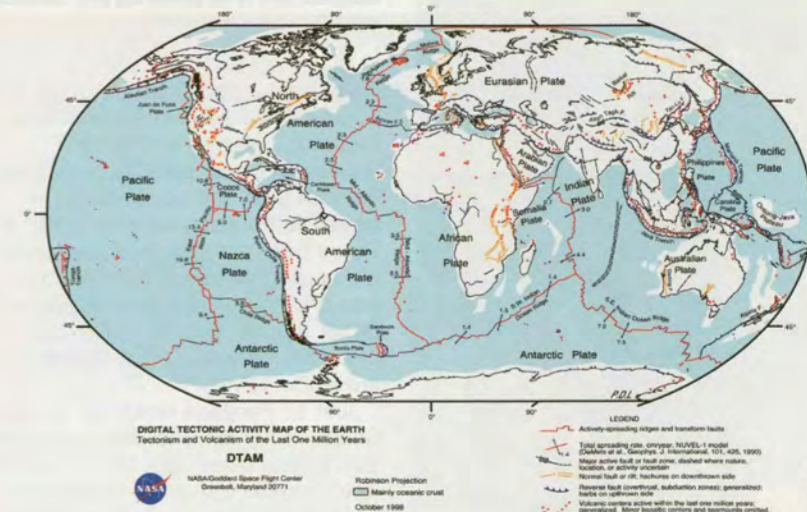
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rest of the planet's surface has been constantly reworked and remade by the forces of geology and climate, Australia has been left relatively untouched for tens of millions of years. Australia's surface has not experienced significant mountain building for millennia. It has also escaped the ravages of advancing glaciers during recent ice ages. And because it is an island, life-forms have had millions of years to evolve in isolation.

### The changing face

The Earth is approximately 4,500 million years old, but its surface is constantly changing. Gigantic plates of the Earth's crust, averaging 100 kilometres thick and thousands of kilometres wide slowly move across the face of the planet. Over millions of years, the whole surface of the planet changes.

In some places, these giant plates crush up against each other causing massive mountain ranges to rise.



In other places, they slide over and under each other forming mighty volcanoes on the surface. Wind, rain and ice continue to shape the Earth's surface wearing down mountains and building layers of rock.

The cumulative effect is Earth's constantly changing face. Continents are shifted and recycled, their surfaces built up and worn away.

The small number of red dots and yellow lines in Australia indicates that there is little earthquake or volcanic activity.

## Origins of an island continent

Australia's story begins some 160 million years ago, a time when dinosaurs roamed the planet. Prior to this, all the continents were pushed together in a single landmass called Pangaea. At about this time, Pangaea split into two super-continents — Laurasia in the north and Gondwana in the south. Gondwana consisted of what was to become Antarctica, South America, Africa, India and Australia.

The banksia is a relative of the South African protea.

Evidence of this event can be found in today's plants and animals. The plants of the family Proteaceae are found in South America, India and South Africa (known for its proteas) and in Australia, where they are known as banksias and grevilleas. Ancient velvet worms (*Peripatus*) are found only in South America, Africa and Australia. There is a basic divide in mammals between the continents of the north, where placental mammals such as antelopes, bears and primates have thrived, and the south, where marsupials such as kangaroos, wombats and possums dominate.



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Marsupials, such as the wombat and bilby, outnumber placental mammals in Australia.

Gondwana straddled the South Pole, but the world's climate at that time was much warmer and wetter. Rainforest trees, such as plum pines (*Podocarpus*) and southern beech trees (*Nothofagus*) covered Gondwana. These trees are still found in Australia. It's hard to picture it but Antarctica was once covered in lush vegetation, rather than kilometres of ice (and there are extensive plant fossils to prove it).

Just as Pangaea broke up, so did Gondwana. India was first to separate, 118 million years ago. Much later it would collide with Asia, creating the spectacular Himalayas. Soon after, Africa and South America went their own way.

The last connection between Australia and Antarctica finally broke 40 million years ago. During the millions of years that followed this separation, the tectonic plate carrying Australia moved north. It was during this time that a combination of factors gave the Australian continent a unique flavour that colours all its land-forms and life-forms.

The Sturt desert pea, in the dry Australian desert.

Jennifer Dettrick



An Australian giant — Mountain Ash (*Eucalyptus regnans*). It is the world's tallest flowering plant, reaching over 100 metres.

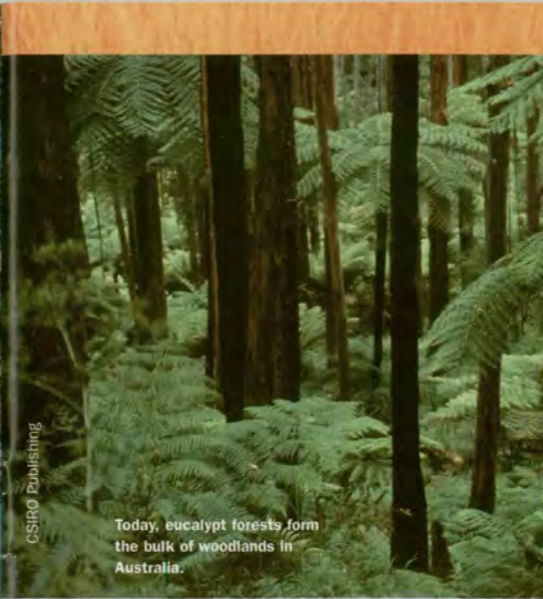
## Stability and stress

The forces that formed Australia were its isolation, geological stability and drying climate.

Geological stability arises from our position on the tectonic plate — centred exactly within a tectonic plate. Over the last 20 to 30 million years, major earthquakes have been rare, volcanic activity limited and there have been no episodes of mountain building.

And yet this very stability has imposed extreme stresses on the organisms that were living here. Without the processes of mountain building, volcano building and glacial weathering, the continent's soils have not been rejuvenated. Long periods of stability means that minerals essential for plant growth are slowly leached from the soils and are not replenished. Over time, they have become infertile, shallow, stony and fragile.

Through this period, Australia has moved north into warmer temperatures. Simultaneously, the world's climate was drying out. The lush rainforests that had covered Australia were ill suited to this increasing aridity. On the edges of the dwindling rainforests, different types of flowering plants evolved to cope with the dry climate and poor soils. Leaves became smaller, thicker and harder — characteristic of much of the bush we see around us today. About this time, two new types of tree took on an increasingly important role in Australia's ecosystems: the gum tree and the wattle.



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Today, eucalypt forests form the bulk of woodlands in Australia.

## Drought and fire

The increasing dryness and unpredictability in the climate opened up the forests. Rainforests retreated to the more mountainous and wetter areas, and eucalyptus forests with an understory of grasses became dominant. Spinifex grass and wattle became a key feature of the semi-arid environment.

Apart from having a dry climate, there is another aspect that has had a profound influence on our animals and plants. Due to the pattern of complex ocean currents around Australia, scientists are slowly unravelling a pattern that shows our continent's weather as extremely variable. It truly is 'a land of drought and flooding rain', and there's evidence to suggest it's been this way for a long, long time.



Fire is essential to the lifecycle of some plants.

CSIRO Forestry and Forest Products



After a bushfire, many plants immediately begin regrowth.

probably triggered by lightning strikes, have occurred across Australia over the last 250,000 years.

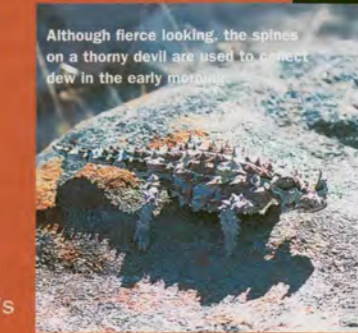
Australia's vegetation is very much a product of this fiery environment. Many eucalypts possess heat-insulating bark, beneath which dormant buds lie in wait, sprouting when the canopy of the tree goes up in flames. In other plants, buried swollen stems replace burnt branches following a fire. Some plants, including many banksias and eucalypts, only release their seeds in response to a fire.

## It truly is 'a land of drought and flooding rain'.

## Our living legacy

The Australian continent and its islands have an estimated:

- 20,000 species of higher plants (90 per cent occur nowhere else);
- 850 species of birds (70 per cent occur nowhere else);
- 146 species of marsupials (52 per cent of the world's total), including two of the world's three monotremes (egg-laying mammals);
- 700 species of reptiles (88 per cent occur nowhere else); the reptile fauna of Australian deserts is the richest in the world.
- 94 per cent of our frog species occur nowhere else.
- 220,000 species of insect (of which it's believed more than a third haven't even been described yet);
- 3,600 species of fish, tens of thousands of species of molluscs; the flora and fauna of Australian coastal waters is one of the most diverse in the world; and
- 250,000 species of fungi (of which only five per cent have been described).



Although fierce looking, the spines on a thorny devil are used to collect dew in the early morning.

David Salt



Clinging onto survival — the marsupial bilby.

CSIRO Centre For Arid Zone Research



European farming methods have turned some areas of Australia into salt affected land.

CSIRO Centre For Arid Zone Research  
Bryan Avery, CSIRO Land and Water



After millions of years of weathering, Australian soils are not very fertile.

Even today  
we are still  
learning the  
behaviour of  
this peculiar  
landscape.

## Enter *Homo sapiens*

It's ironic that this wide brown land that has weathered millennia of drought, flood, fire and poor soils, should be profoundly disrupted by the arrival of one animal species. On first appearance, this species seems soft, delicate and quite vulnerable to the elements — *Homo sapiens*.

Aboriginal people are thought to have arrived in Australia between 40,000 to 60,000 years ago. They are not believed to have brought many new species with them, but their use of fire to alter the Australian bush had a significant influence on many ecosystems. It's been recently suggested that the arrival of the Aborigines is directly connected with the extinction of many of Australia's larger animals. The debate on this continues.

What is certain is that while the Aborigines had an impact on Australia's ecosystems, they understood them well enough to live with them in harmony. To have prospered in one of the harshest, most unforgiving continents on the planet for tens of thousands of the years, is a remarkable feat.

The Europeans arrived with many preconceptions about rich, deep soils capable of growing large amounts of food and fibre, and of good rains and predictable weather, like those found in the Northern hemisphere.

It didn't take long for them to discover the truth. For the first colonists it must have been a tortuous time. Their crops failed because the soil wasn't rich enough. The weather seemed unpredictable, with more bad years than good. Even the trees seemed hostile — so hard in fact, that the European tools they had brought with them bowed and broke.

In 1789, Robert Ross, Lieutenant Governor of the new colony at Port Jackson, wrote: "In the whole world there is no worse country . . . so very barren and forbidding that it may be with truth said that here nature is reversed".

And yet history shows that the colonists prevailed. Their science and technology found ways of augmenting the soil to produce food, and find buried water to open up the arid interior. Vast areas of land were cleared and irrigated to grow cereals, vegetables, fruits and livestock. European animals such as rabbits, foxes and sparrows were released to make this alien nation a little more like a European home.

Two hundred years later and we're seeing the effects of clearing, of large-scale modifications to the landscape, and of the impact of feral animals and plants. Whole ecosystems are unravelling. Animals and plants are being lost forever and growing segments of the land are losing their productive capacity. Even today we are still learning the behaviour of this peculiar landscape. Will we learn to exist in balance with the land? Will we still be here in 40,000 years?



The fox has become one of Australia's great ecological problems.

CSIRO Centre For Arid Zone Research

## An ancient legacy

Like it or not, we are responsible for this country. Each and every one of us carries a duty of care. Australia's diversity of life is breathtaking, and many species of plant and animal can only be found here. The balance of life is fragile, and humans have had a profound impact.

Next time you hear a tourist comment on the flatness, dryness or the bleakness of an Australian scene, step right up and help them understand what they're looking at. As a foreigner, the complexity and subtlety of the land might be beyond them. However, as a local you should know better, for you now share this ancient legacy.



Australia's beauty is an ancient legacy — the Pinnacles, Nambung National Park, Western Australia.

David Salt



David Salt

## Hidden treasures

Have all of Australia's biological wonders been discovered? Based on recent finds, it's highly unlikely.

A little more than a year ago, divers exploring underwater caves in the Nullarbor found mats of white filaments hanging from the roof. Tests by scientists at Macquarie University revealed that the filaments were colonies of a new form of bacteria. This was not merely a new species, but it was an entirely new phyla that may have been separated from all other ecosystems for periods of tens of millions of years.

New subterranean bacteria are one thing, but imagine finding a massive 'living fossil' tree close to Sydney. That's exactly what happened a few years ago when bushwalkers stumbled on the Wollemi Pine in the Blue Mountains. Not only did they discover a new species, this dinosaur pine turned out to be a new genus that had been distinct from any other surviving plant family for at least 65 million years — the time of the Jurassic period.

It's a sure bet that there are dozens of other stunning discoveries waiting to be made. The tragedy is that many of these may disappear before anyone knows they were here.

Australia is a biological treasure chest. Far from having exhausted its precious contents, we've only just opened it for exploration.



The oldest life forms on Earth — stromatolites in Shark Bay.

David Salt

## Old as the hills

Australia's ancient legacy extends back to the very origins of this planet. It also holds clues to the nature of Earth's earliest life, and the remains of its first animals.

## Oldest rock

In the early 1980s, geologists looking for the oldest rocks on Earth were searching the desolate landscape 300 kilometres east of Shark Bay, Western Australia.

The rocks in this area were mostly 2.5 billion years old. Among these deposits they found sedimentary rock made of older rocky material and containing tiny crystals of the mineral zircon that have been dated at 4.3 billion years old! These are the oldest known fragments of our planet (4.5 billion years old), and they contain clues to the formation of the Earth, the Moon and other parts of the solar system.



The oldest part of the Earth — Mount Narryer, Western Australia.

## Oldest life

Several hundred kilometres north of Mount Narryer is a place called North Pole, which is a hot, forbidding area (unlike the frozen North Pole at the top of the planet).

Here you can find fossilised stromatolites — layers of limestone



There is beauty in Australia's landscape, which is rich in colour.

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and sand cemented together by colonies of blue-green algae (photosynthetic bacteria). These fossils date back a staggering 3.5 billion years, which makes them the earliest evidence of life on Earth.

Then, in the mid-1950s, scientists were amazed to discover living stromatolites growing in Shark Bay. Resembling large stone cauliflowers, they stand motionless in the intertidal zone. The microscopic bacteria that built them add a miniscule 0.4 millimetres to their girth every year. Many of the domes are more than a metre wide and 0.4 metres tall, making these living fossils more than 1000 years old.

## Oldest animals

In 1946, a geologist wandering through the Ediacaran Hills in the Flinders Ranges, stumbled upon a rich trove of fossil treasure containing jelly fish, primitive worms, sea pens and disc-like animals that predated all other known fossilised animals.

They were named the Ediacarans and they lived some 600 million years ago on the sandy bottoms of shallow seas. The beginning of the story of animal life on Earth is here, and its record is found stamped in the ancient rocks of Australia.