



BELOW THE SURFACE

karst systems of Western Australia

We explore the magnificent caves and karst systems in Western Australia that give us a window to the past.

by Professor Ross Dowling and Andy Spate





Caves are our ‘windows to the past’. They are natural museums that can preserve the remains of past megafauna, be sites of early human occupation, and often contain vital natural evidence of past climate.

In addition, they can contain spectacular cave decorations termed speleothems (stalactites, stalagmites and other forms), as well as bizarre communities of creatures such as troglobites, which are creatures that have adapted to permanent life in a cave (see ‘Life down under: the mysterious world of subterranean fauna’, *LANDSCOPE*, Spring 2021).

In Australia there are fewer caves and karst landscapes than on other continents but there are incredible examples of these—caves, cliffs, depressions and extensive underground water systems.

In Western Australia there are four main areas of karst systems—Pleistocene near-coastal lime-rich dunes and limestones derived from dunes in the south-west; Palaeocene–Oligocene limestones of Cape Range and Barrow

Island; Devonian reef limestone ranges of the Kimberley; and Tertiary limestones of the Nullarbor Plain.

SOUTH-WEST

The coastal limestone of this area was formed during the Pleistocene era (during the past two million years) and the largest area of this limestone sits on the Leeuwin-Naturaliste Ridge within Leeuwin-Naturaliste National Park. The ridge has many popular caves and extremely important karst aquifers.

Commonly, limestone forms from deposits under the sea, but in the south-west the rock is aeolian (windblown) and is formed by cementation of lime-rich sand blown up from beaches into dunes up to nearly 200 metres high.

Aeolian limestone is much more porous than marine limestone, so it can be dissolved quite easily by mildly acidic groundwater. It also allows the water from the surface to percolate through the rock strata relatively easily, creating the perfect conditions for very fast crystal growth.

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Main Fig Tree Cave, Cape Range National Park.
Photo – Danny Wilkinson

Above Brides Cave, Boranup Karri Forest Leeuwin-Naturaliste National Park.
Photo – Tourism WA

COASTAL CAVES

The remarkable history of Aboriginal occupation of WA’s south-west as well as the extinction of animals at the end of the last Ice Age have been documented through fossil finds in the caves.

Mammoth Cave in Margaret River contains fossil remains of a dozen species of megafauna—giant animals that became extinct about 46,000 years ago. These include giant two-metre tall kangaroos, giant emus, and *Thylacoleo carnifex*, a tree-climbing marsupial, sometimes called a marsupial ‘lion’.

Giants Cave is 575 metres long and 86 metres deep, and offers adventurers exciting finds such as the spectacular Ballroom Chamber (see ‘Adventure out:



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Above Thick roots of a fig tree, growing through the ceiling of an unnamed cave near Exmouth.

Photo – Darren Brooks

Above right Weelawadgi Cave in Beekeepers Nature Reserve near Eneabba.

Right Arumvale Cave, Boranup Karri Forest Leeuwin-Naturaliste National Park.

Photos – Danny Wilkinson

Cave terms

- **Anticlinal crest** – a convex fold of rock layers that are progressively older towards the centre of the fold.
- **Column** – forms when a stalactite and stalagmite join.
- **Flowstone** – occurs when solution seeps out of the wall of the cave or flows over a gently sloping section of floor depositing sheets of calcite over a relatively large area.
- **Helictite** – speleothem that defies gravity growing in many different directions, twisted and worm-like.
- **Karst** – a landform type found on soluble rocks, usually limestone, characterised by underground drainage systems with sinkholes and caves.
- **Phytokarst** – a type of karst rock formation created in areas of limestone caves where sunlight is present.
- **Shawl** – wavy sheet of calcite that hangs from the ceiling or wall.
- **Speleothem** – cave decoration. They are usually made from calcite, a crystalline form of calcium carbonate.
- **Stalactite** – a speleothem that looks like an icicle and hangs from the roof of a cave.
- **Straw** – a long, thin stalactite with a hollow centre resembling a drinking straw in appearance.
- **Stalagmite** – a speleothem rising from the floor of a cave.

Giants Cave', page 37). Lake Cave, with its mirrored waters, is particularly impressive and has been described as a crystal wonderland with its range of cave features including showers of straws, actively-dripping/growing flowstone and the iconic five-tonne upside-down 'suspended table'.

Jewel Cave is the largest tourist cave in Western Australia and is centred on a cathedral-like chamber. It houses a number of spectacular features such as the 'frozen waterfall', the 'organ pipes', thousands of mind-bending helictites; and crystal 'worms' that grow against gravity.

Calgardup Cave is a self-guided cave with two separate large sections and a subterranean lake that is home to an excellent array of crustaceans. Further to the north of the Leeuwin-Naturaliste Ridge, Ngilgi Cave is like a labyrinth of discovery with its multiple levels and chambers and was WA's first cave tourist attraction.

YANCHEP NATIONAL PARK

Nearest to Perth are the caves of Yanchep National Park. Located on the Swan Coastal Plain just 50 kilometres north of Perth, this park has an Aboriginal history dating back more than 40,000 years. The park contains extensive outcrops of limestone and under the surface lies a labyrinth of more than 580 caves.

The caves are geologically young at around 500,000 years old, and feature some stunning speleothems including stalactites, stalagmites, shawls, columns and straws.

The park is popular, averaging 350,000 visitors per year. The main tourist attraction, Crystal Cave, has been open to the public as a tourist attraction since the late 1960s and Cabaret Cave has been used as a function centre for weddings and other events since the early 1930s.

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Above right Napier Range, West Kimberley, showing the exposed Devonian reef.
Photo – Marie Lochman



Crystal Cave recently underwent some renovations. A new boardwalk within the cave reduces dust levels and provides an experience for all ages.

In recent decades, the Yanchep caves have experienced a drying trend. This has been attributed to the falling water table of the Gnangara Mound through a combination of pine plantations on the land surface, reduced rainfall as a result of climate change and ongoing extraction of groundwater for urban use.

Another threat to the caves and the park is bushfires. One which occurred on 11 December 2019 has resulted in a slow-down of the karst processes due to the changes in cave hydrology. The fire history at Yanchep can be found in the stalagmite records dating back to the first European settlement and beyond.

CAPE RANGE

Cape Range, 1200 kilometres north of Perth, is a limestone range which is about 100 kilometres long and 20 kilometres wide. It was deposited on the sea floor as horizontal beds of lime during the Palaeocene to Pliocene eras (approximately 60 to two million years

ago). The range comprises an eroded anticlinal crest having the character of plateau karst, flanked by typical plains karst and areas of coastal karst. A variety of sinkholes and hundreds of caves occur throughout the range.

The rock comprises broken fossil material, including coral, crustacean fragments and sponges, and the caves are also rich in calcareous (carbonate-rich) microfossils. In the depths of the caves live troglitic cave fauna that date back millions of years. Interestingly, there are variations in the species present in different parts of the range suggesting that the cave systems are not connected to each other, which allowed the fauna to evolve in isolation.

KIMBERLEY DEVONIAN REEF

Three hundred and fifty million years ago, a vast tropical sea covered much of Australia's north-west. A 'great barrier reef' fringed the ancient Kimberley land mass during the Devonian period (375–350 million years ago). These rocks were initially covered and protected by younger sediments, which have since slowly eroded

“Ngilgi Cave is like a labyrinth of discovery with its multiple levels and chambers and was Western Australia’s first cave tourist attraction.”



to expose the remnants of the reefs as low but very rugged limestone ranges.

Located in western Kimberley, these magnificent limestone ranges are between 0.1 and 1.8 kilometres wide, rising up to 100 metres above the surrounding plains and, although crossed by a number of gorges, extend for hundreds of kilometres and represent an exhumed Devonian reef in the Napier, Oscar and Ningbing ranges. They extend in a south easterly direction for 350 kilometres. Today the Devonian Reef, Danggu Geikie Gorge, Bandilngan (Windjana Gorge) and Dimalurru (Tunnel Creek) national parks include parts of these ranges.

There have been suggestions that the Devonian Reef complex warrants World Heritage status.

Numerous caves are found within the limestone with the best-known being Tunnel Creek Cave. A creek flows through this large cave once known as ‘The Cave of Bats’ as it is home to five species of bats. Tunnel Creek Cave is approximately 750 metres long and reaches a height of 12 metres and a width of 15 metres. It cuts right through the limestone Napier Range. Visitors can hike through the entire cave

system with ease, guided by daylight from a large roof window in the centre. On the floor of the cave are large pools of water where freshwater crocodiles can be found.

THE NULLARBOR PLAIN

Western Australia hosts more than two-thirds of the 220,000 square kilometres of tertiary limestones of the Nullarbor Plain that were deposited between about 35 and five million years ago. Decried by many travellers as ‘flat and boring’, the Nullarbor is anything but! It has thousands of karst features—big and small—hundreds of caves including deep caves with extensive lakes and suites of shallow to deep caves associated with uplift occurring over the past 30 million years or so, giving us the Nullarbor’s iconic vast limestone sea cliffs. Ancient river valleys traverse this karst reflecting a much wetter past. Many experts consider that the Nullarbor has World Heritage significance for its natural and cultural values.

The Nullarbor Plain is among the world’s largest single exposures of limestone bedrock. The name of this vast plain comes from the latin ‘null arbor’



Top Ngilgi Cave near Yallingup, Leeuwin-Naturaliste National Park.
Photo – Danny Wilkinson

Above Crystal Cave in Yanchep National Park, now dry, was once filled with water.
Photo – DBCA



Geological age of WA cave regions

Caves	Period	MYBP*
Yanchep National Park	Pleistocene	0.04 – recent
Leeuwin-Naturaliste National Park		
Cape Range National Park	Palaeocene - Oligocene	66 – 23
Nullarbor Plain		
Devonian reefs of the Kimberley	Devonian	419 – 358

* MYBP = Millions of years before present



meaning 'no trees'. At its widest point, it stretches about 1100 kilometres along the southern coast of WA extending into South Australia. It is a former shallow seabed, which is now a world-class karst region comprising Nullarbor limestone of Oligocene and Miocene ages.

It includes the Old Homestead Cave, one of Australia's longest cave systems comprising about 34 kilometres of tunnels and chambers across four levels. They are filled with speleothems and gypsum crystals that grow out from the walls. A number of the large deep caves feature underwater lakes and extensive water-filled tunnel systems.

The WA Museum staff and other people have been finding important information about the former wildlife of Australia as the remains of animals that fell into these caves have been protected in the stable and dehydrating environment deep within the caves.

The visibility in these waters has been measured at more than 50 metres and the Nullarbor is a mecca for the world's cave

divers. In 2002, in one of the caves, a WA Museum expedition, which included Eve Taylor, a cave guide at Yanchep National Park, found an almost complete skeleton of the *Thylacoleo carnifex* or marsupial 'lion', which is described as being the size of a leopard but built like a bear.

When you're driving across or flying over the Nullarbor, it is a good time to reflect on what lies beneath.

Top left WA's oldest cave system in Dimalurru (Tunnel Creek) National Park.
Photo – Peter Nicholas/DBCA

Top Sampling the world's tallest salt stalagmite in Webbs Cave, Nullarbor Plain, that fell and broke some time between the 1930s and 1980s.
Photo – Adrian Davey

Above A cave entrance on the Nullarbor Plain.
Photo – Jiri Lochman

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Learn more about WA's caves systems in *Discovering Caves of Western Australia*, available for \$6.95 from shop.dbca.wa.gov.au

