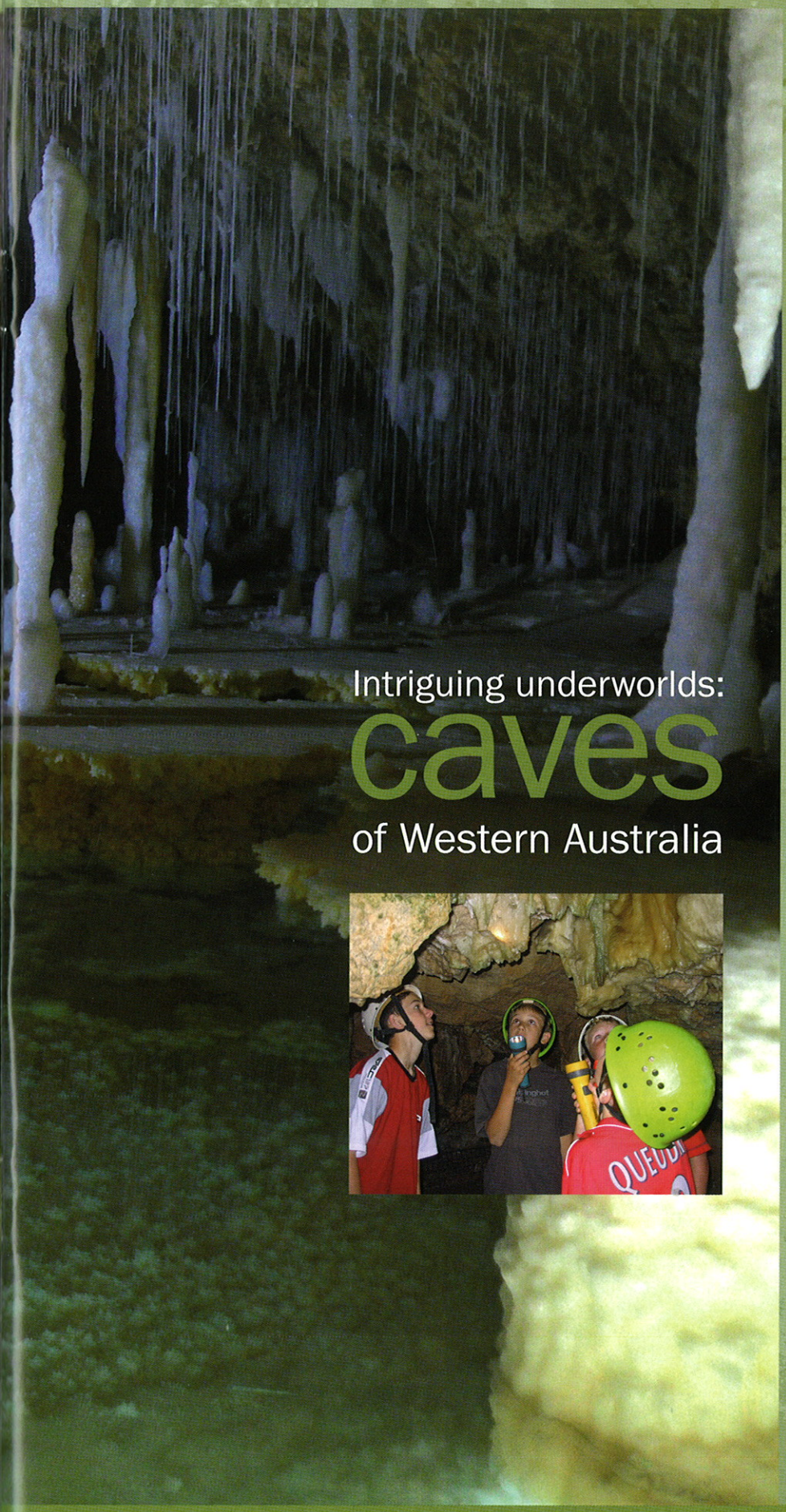


Intriguing underworlds: caves of Western Australia

Caves fascinate visitors with their dazzling forms and contain evidence of early human and animal life in Western Australia.

by Samille Mitchell and Anne Wood

Caves hold an almost primal fascination to visitors. It's simply enthralling to explore their dark reaches, marvel at their jewel-like forms and guess at the people or animals who have used them over the millennia. You may be in a cave steeped in Aboriginal legend, one that is home to prehistoric fossils or you may be somewhere that harbours bizarre life forms found nowhere else in the world.

Western Australia is home to thousands of caves ranging from yawning caverns complete with dazzling crystal-like formations to tiny tunnels wending deep within the earth. Many come adorned with underground streams or mirror-like lakes, further adding to their beauty. The south-west is particularly rich in enchanting caves open to tourists.

Cave formation

Caves are mostly formed within areas of limestone, which is partially soluble and therefore prone to dissolution into features like caves and gorges. These landscapes, formed mainly by the dissolving of rock, are known as karst landscapes. In addition to caves, karst features include such formations known as limestone pavements, closed depressions known as dolines and the Pinnacles in Nambung National Park near Cervantes.

But what exactly is limestone and how does it form? Limestone is a sedimentary rock containing at least 50 per cent calcium carbonate. Most limestone was formed in ancient seas by marine animals, plants and micro-organisms that made use of the calcium carbonate from the sea water in the construction of their shells, skeletons and other structures. The main areas of limestone in WA occur in the south-west, Nullarbor, Cape Range near Exmouth and Kimberley.

Limestone is not very soluble in pure water, however, ground water is usually slightly acidic due to the presence of carbon dioxide from plant decay. This forms weak carbonic acid which, over great periods of time, can dissolve away the rock to form caves. Most caves were formed by water moving slowly through the zone below the water table, mainly at the top of the saturated zone. Cave passages may form along cracks and fractures in the limestone.

Nature's crystal wonderland

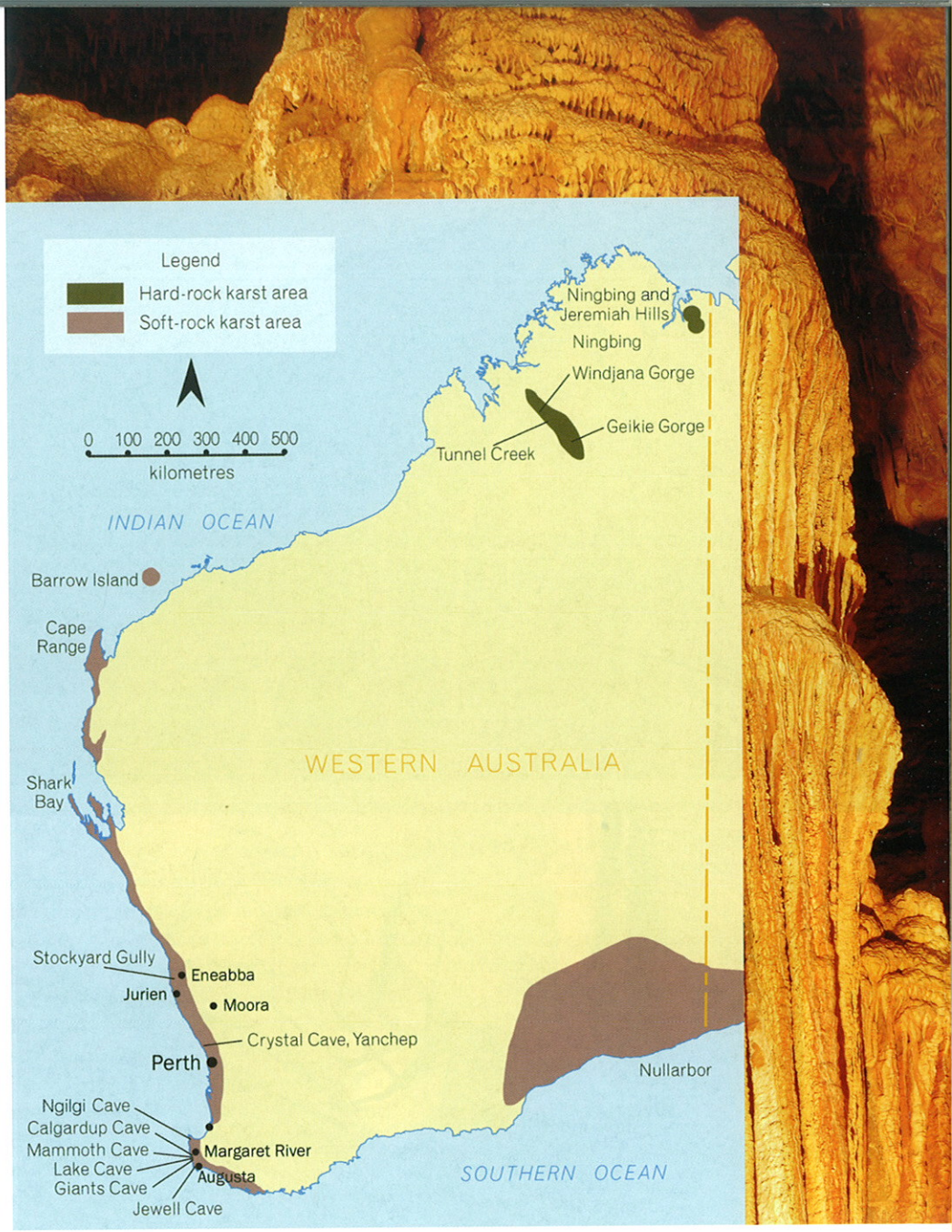
The most spectacular caves are home to decorations known as speleothems. These natural formations form an underworld of dazzling beauty and intrigue. They shine like jewels, hang like daggers and adorn cave walls, ceilings and floors with weird and wonderful forms. They range in size from minute helictites, only a few millimetres long, to large pillars and flowstones weighing several tonnes. There are also stalactites, stalagmites, shawls, columns and straws. But what exactly are these weird formations and how do they form?

The speleothems typically found within caves come from a secondary deposition, usually of calcite (calcium carbonate crystal). Other depositions found in WA are halite (sodium chloride or common table salt) and gypsum (calcium sulphate). Cave decorations usually take many thousands of years to form and are therefore non-renewable in human lifetime scales.

Speleothems are created when slightly acidic water seeps down through the limestone bedrock and dissolves calcium carbonate. When the solution reaches an air-filled cave, a discharge of carbon dioxide may alter the water's ability to hold these minerals in solution, causing its solutes to precipitate. Over time, the accumulation of these precipitates may form speleothems. The rate of speleothem growth depends on the amount of carbon dioxide held in solution, rainfall, surface vegetation, density of the limestone, temperature, and other factors. Different combinations of factors create different speleothems.

Previous page
Main A cave in the Boranup Forest in Leeuwin-Naturaliste National Park near Margaret River. Some caves are so fragile that specially permitted visitors must remove their shoes.
Photo – Ross Anderson
Inset Yanchep National Park cave.
Photo – DEC

Left Lake Cave.
Photo – Samille Mitchell/DEC



Top left Pendulites.
Photo – Brian Combley

Above left Helictites.

Background above Diverse cave formations.
Photos – Samille Mitchell/DEC

Ancient animals

Caves can act as windows to the past—virtual museums of treasures that provide clues to ancient animals which once roamed the Earth, early human inhabitants and climate from days long past.

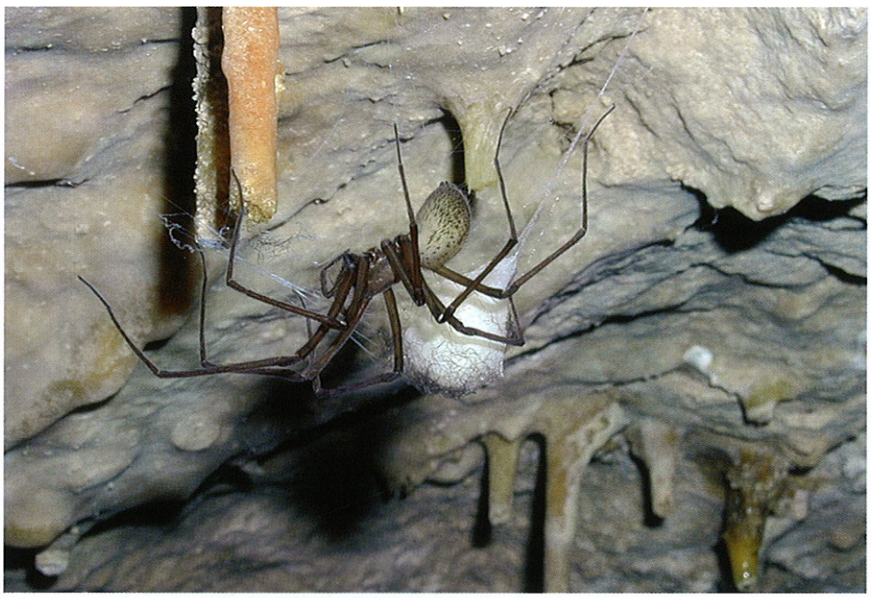
A cave's constant conditions, alkaline environment and protection from disturbance means they are ideal for preservation of fossil and sub-fossil material. As such, caves are often home to fossilised remains of animals that may have fallen into caves, animals that may have used the cave as a lair or bones that have washed into caves.

Several caves in the south-west are particularly well known for their megafauna, which are animals weighing more than 45 kilograms that became extinct about 45,000 years ago.

For example, Mammoth Cave in the south-west has remains of long-extinct animals like a giant marsupial called *Zygomaturus trilobus*, that was the size of a small hippopotamus and may have lived like a marsupial version of a hippo, inhabiting swampy regions and feeding on plants. A partial skeleton of a giant echidna sized one-metre long and called *Zaglossus hacketti* was also discovered here—the biggest known monotreme ever discovered. And two species of the now extinct short-faced kangaroo were also discovered in Mammoth Cave, preserved deep below the earth.

In the Kimberley, Windjana Gorge in Windjana Gorge National Park holds the bones of *Diprotodon* (another long-extinct, hippo-like creature), the teeth of an extinct giant crocodile and scant remains of a thylacine, more commonly known as a Tasmanian tiger.

Mummified thylacine remains were also discovered in Thylacine Hole in the Nullarbor and dated at 4,500 years old. Nullarbor caves also have complete skeletons of the marsupial lion (*Thylacoleo carnifex*), skeletons of three species of short-faced kangaroos and bones of a giant wombat (*Phascolonus gigas*), a giant kangaroo (*Procoptodon goliah*), extinct species of wallaby and



more. These remains are dated from the Pleistocene epoch, from 180,000 to 11,550 years ago, and are the best preserved examples found in Australia.

Early humans

Ancient human occupation has been revealed from the depths of Western Australian caves. The cave called Devil's Lair, in the south-west, has stone and bone artefacts, intact campfire ash-beds and enormous quantities of mammal and other bones which show Aboriginal people used the area some 50,000 years ago. Some of the stone artefacts were used as tools—proof the caves were used for preparing food, making wooden implements and carrying out other camp activities. The discovery of teeth from young children suggests family groups visited the cave. However, occupation seems to have been very occasional, perhaps taking place only during cold or wet weather.

Other caves in the region show food remains, identified as such because they are charred and occur in beds of long-dead campfires, and many of the bigger mammal bones had been deliberately smashed, offering further proof of human occupation.

Caves closer to the coast are home to more camp fire beds, quartz artefacts, vertebrate remains (including fish) and marine and freshwater mollusc shells. They are dated at 800 years old and provide evidence that these caves were used as overnight and meal camps.

Caves in other areas have revealed fragments of burnt emu eggshell, indicating Aboriginal people ate emu eggs when available, and one site contained many kangaroo jawbones without front teeth, possibly because the teeth were removed to make tools or ornaments.

Top left Giants Cave.
Photo – Samille Mitchell/DEC

Centre left Cave spider.
Photo – Anne Wood/DEC

Left Calgardup Cave.
Photo – Michael James/DEC

Above left Bride Cave is a popular abseil site in the Leeuwin-Naturaliste area.
Photo – Marie Lochman

Above Giant limestone caves are common in the Nullarbor.
Photo – Ross Anderson

Cave life

The dark reaches of caves offer too little light for plant growth and are therefore not associated with the number and variety of life forms found in surface habitats. But these intense black habitats are sometimes home to communities of bizarre creatures —many of which live nowhere else in the world but their own cave.

Troglobites are species that spend their entire lives in subterranean habitats, and can't survive elsewhere. They live an amphibious or terrestrial lifestyle. They usually have reduced or totally missing eyes and pigmentation. They often have elongated appendages such as antennae and legs. Troglobites are adapted to a very narrow range of environmental conditions such as temperature and humidity and so are particularly sensitive to change.

Some animals (troglophiles) may live their entire life within caves, but can also be found living in suitable surface habitats. Yet others (trogloxenes) may live part of the time in caves, and part outside. Cave-dwelling bats are an example of this. They shelter within suitable caves but must leave periodically to find food.

Stygofauna are creatures which live fully in water. They include cave-dwelling crustacean species such as remipedes, amphipods, copepods and ostracods. Given the dark environments in which they live, most of these creatures are without pigmentation and eyeless, or have only residual eyes.

Cape Range National Park near Exmouth is home to one of the most significant cave fauna areas on Earth. The terrestrial fauna is a relict of a much wetter past, but the present day arid climate has resulted in the extinction of related surface-dwelling species. The aquatic fauna includes Australia's only two troglobitic fish, the blind gudgeon and the blind cave eel.

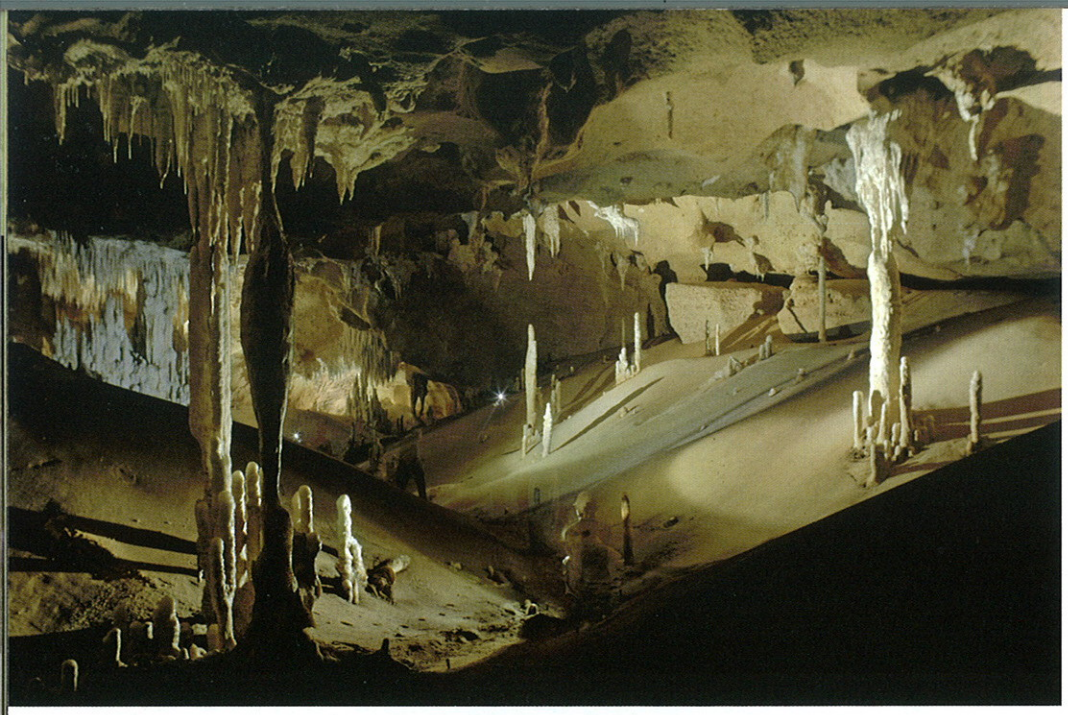
Caves that feature mats of roots from trees growing above, such as some at Yanchep National Park and in the Leeuwin-Naturaliste Ridge, may harbour many aquatic cave animals. The root mats provide food and shelter for these animals, which include invertebrates and some night fish. Some of these species are ancient. And some of the root mat communities are listed as critically endangered due mainly to their limited distributions and falling water levels.

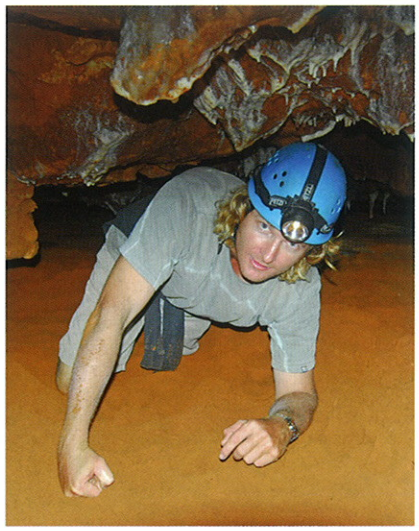
Cave hotspot

The Leeuwin-Naturaliste Ridge in the south-west is the biggest area of coastal limestone in WA and features the most easily accessible and stunningly decorated caves. The Department of Environment and Conservation (DEC) manages two of these caves —Calgardup and Giants. Calgardup Cave is unlit and self-guided, providing the opportunity to explore at your own pace. It is fascinating to run the beam of your head or hand torch over the cave walls and see what formations appear in the light. It's also enjoyable to sit on one of the several seats in the cave and soak up the enchanting atmosphere. In addition to beautiful crystal formations, Calgardup Cave contains a stream that trickles through the cave all year around, carrying nutrients to the tiny cave creatures that inhabit the water and many tree roots that can be seen dangling from the roof and trailing into the water.

Calgardup Cave is also an information centre for the Leeuwin-Naturaliste National Park and the booking centre for the cave and abseil permit system that manages access to the adventure caves and wild caves in the area.

Giants Cave is one of the biggest and deepest caves on the Leeuwin-





Above A cave in the Eneabba area.
Photo – Ross Anderson

Above right Adventure tours are popular at Ngilgi Cave near Yallingup.
Photo – Samille Mitchell/DEC

Naturaliste Ridge. It is entered via a spectacular collapsed doline almost 100 metres in diameter, and plunges 86 metres into the earth. You can explore its dark reaches on a self-guided tour, scrambling up ladders, squeezing through tunnels and meandering through enormous caverns. The infrastructure is minimal, meaning you feel like an early explorer discovering this underground wonder.

Further north near Yallingup is the stunning Ngilgi Cave, managed by Geographe Bay Tourism Association. Ngilgi was the first cave in WA to be opened to tourists. It has enchanted visitors with its dazzling forms for more than a century, and also features in the legends of the local Wardandi Aboriginal people.

You can join a semi-guided cave tour which provides information about the cave but also gives you time to explore yourself. Adventure tours with hard hats and head torches are also available for those wishing to witness the cave's deepest reaches—an exhilarating way to explore.

Caveworks runs another three caves open to tourists on Caves Road—Mammoth, Lake and Jewell. Mammoth Cave is one of the south-west's biggest and most spectacular caves. Its enormous caverns are thickly encrusted with exquisitely beautiful forms. Mammoth Cave is also a natural time capsule—home to ancient fossil remains of extinct animals.

Lake Cave's watery entrance makes this cave particularly stunning, as it reflects the strikingly lit formations that encrust the ceiling and walls. In fact, this cave has one of the most impressive and beautiful entrances of all the Western Australian tourist caves. It occurs at the bottom of a huge closed depression, and is so named because of an underground lake, which is formed by a stream flowing through the cave.

Jewel Cave is a treasure chest of lavish cave formations that range from tiny, crystal-like clusters to enormous flowstones that glow gold in the artificial light. The cave is named after the Jewel Casket, a small formation in the lower section of the cave. As you enter the cave, you'll encounter a huge chamber and several tree roots spiraling down from the roof. These are the roots of karri and marri trees seeking moisture far below.

Protecting caves

Many coastal towns, farms and even suburbs of Perth are situated on karst. This makes these areas prone to problems like sinking, collapse, and pollution of groundwater. Groundwater moves rapidly through karst areas with little opportunity for filtering. As such, to protect karst areas it is necessary to consider and protect the entire catchment area.

Sinkholes and collapses in karst areas can occur spontaneously but are often the consequence of changing land use and drainage on the surface. For example, burst water pipes have been responsible for several land collapses in karst areas—a major problem if houses or infrastructure are situated nearby.

When visiting caves it is important to remember that they are sensitive to environmental impacts. Caves are usually very stable environments where any change can have an adverse effect. Visitors should move carefully, disturb as little as possible, and leave nothing behind. Any damage must be considered irreversible in human lifetime scales. For this reason, DEC and other cave managers restrict access to caves to ensure visitors remain on boardwalks and designated paths. By doing so, they prevent damage to the fragile decorations that visitors have come to admire.

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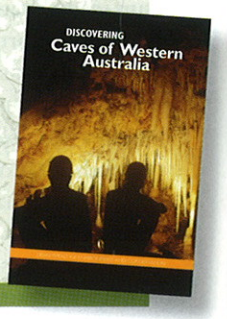
Information in this article is based on the newly released book *Discovering the Caves of Western Australia*. The book is available for $6.50 from bookshops and tourist outlets, by phoning WA Naturally Publications on (08) 9334 0437, by ordering online at www.dec.wa.gov.au/shop or using the order form between pages 40 and 41.



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