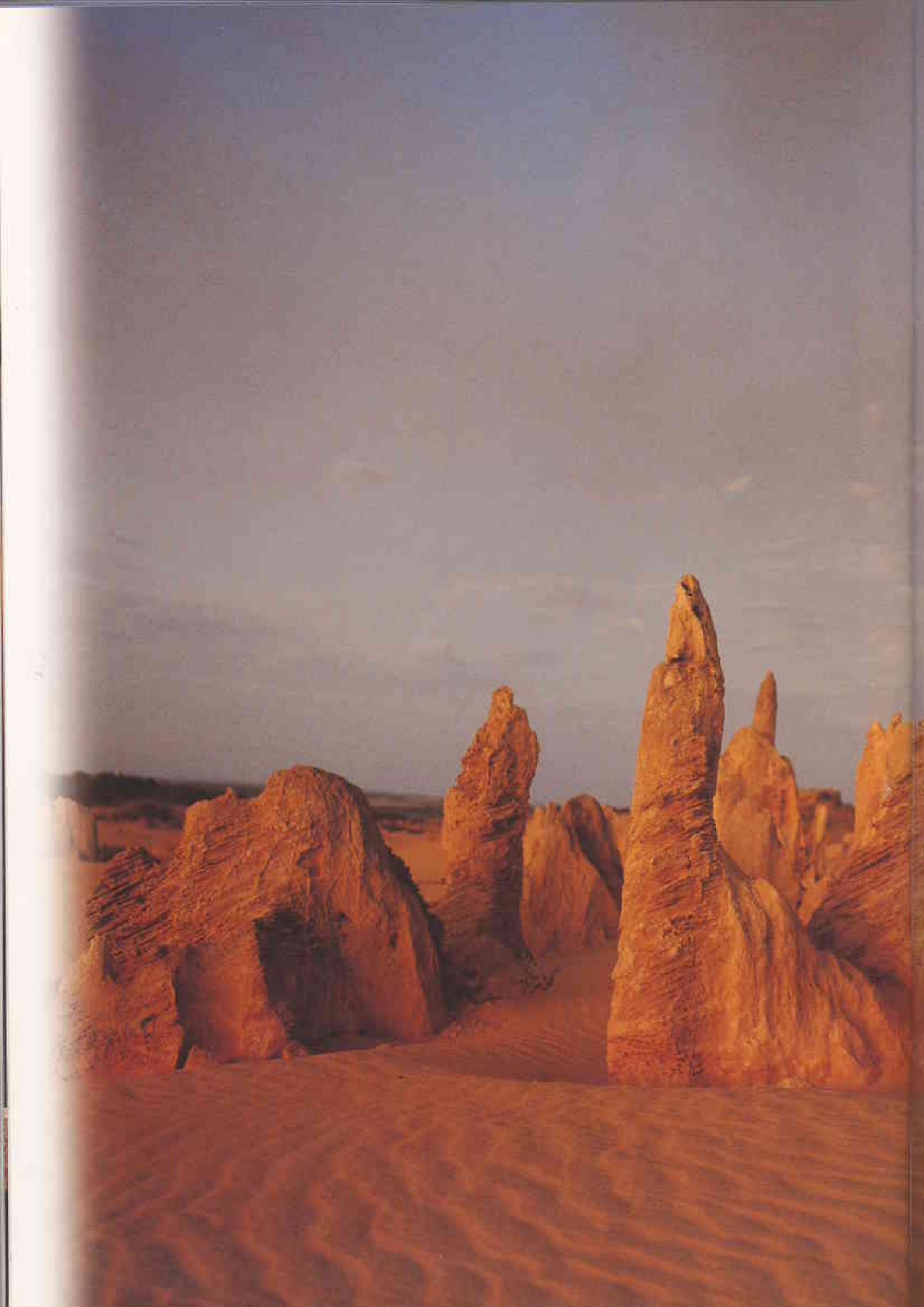
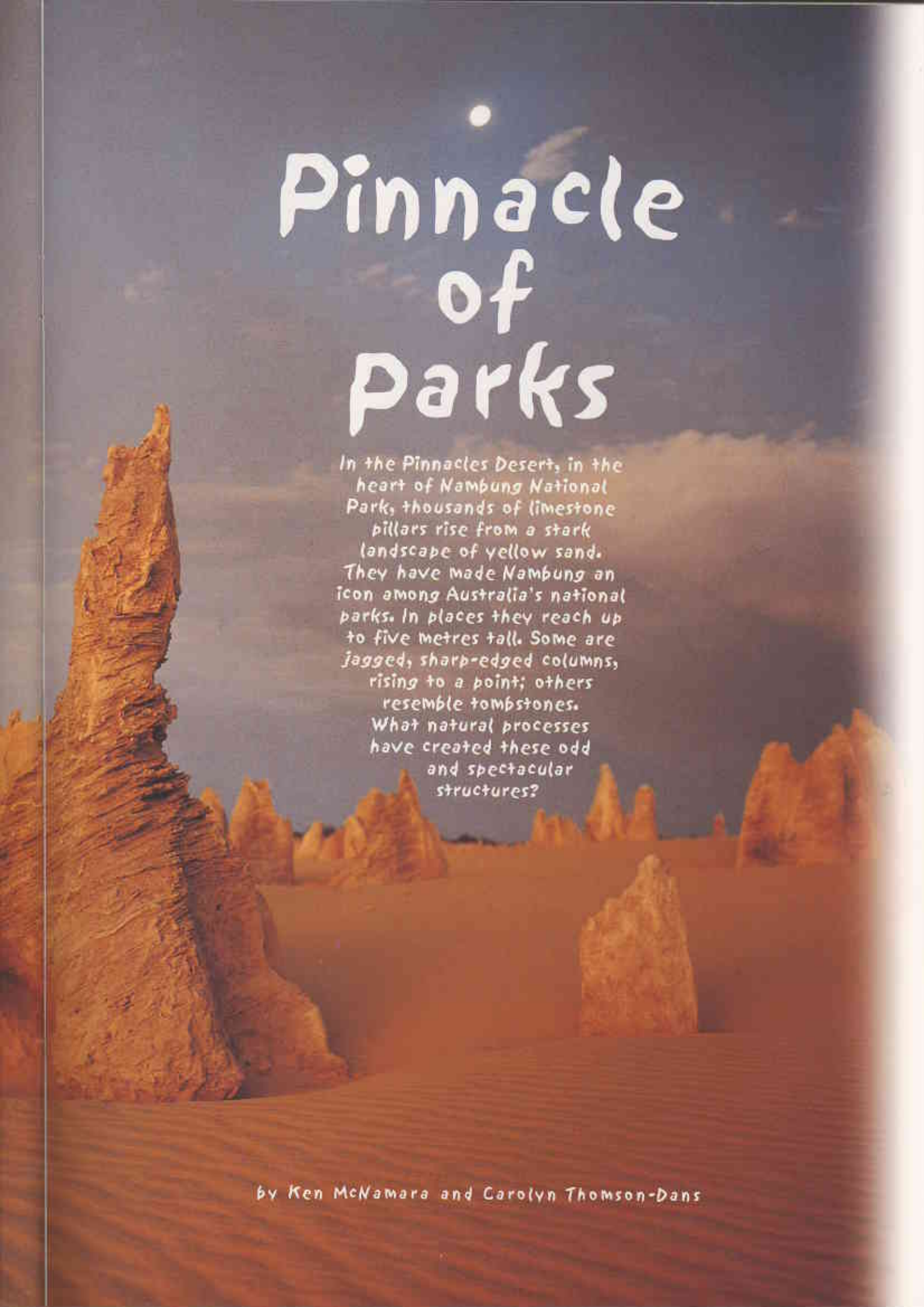




Pinnacle of Parks

In the Pinnacles Desert, in the heart of Nambung National Park, thousands of limestone pillars rise from a stark landscape of yellow sand. They have made Nambung an icon among Australia's national parks. In places they reach up to five metres tall. Some are jagged, sharp-edged columns, rising to a point; others resemble tombstones. What natural processes have created these odd and spectacular structures?

by Ken McNamara and Carolyn Thomson-Dans

Nambung National Park, a park of 18,318 hectares located about 250 kilometres north of Perth, features beautiful beaches, coastal dune systems, shady groves of tuart trees and low heathlands rich in flowering plants. In the midst of this diversity is one of Australia's most fascinating areas—the Pinnacles Desert. Here, thousands of huge limestone pillars rise from the shifting yellow sands, resembling a landscape from a science fiction movie.

Previous page
Dusk enriches the colours of the Pinnacles Desert at Nambung National Park.
Photo – Steve Sadler

Below: Different coloured limestone beds are evident in these striking pinnacles.
Photo – Bill Bachman

FORMATION OF THE PINNACLES

The raw material for the limestone of the pinnacles came from sea shells from an earlier era. These shells were broken down into lime-rich sands, which were brought ashore by waves and then carried inland by the wind to form high, mobile dunes. Three distinct systems of sand dunes run parallel to the coast between Nambung and Busselton, further south. These dune systems mark ancient shorelines.

In the winter, rain, which is slightly acidic, dissolved small amounts of calcium carbonate as it percolated down through the lime-rich sand. As the dunes dried out in summer, this was precipitated as a cement around grains of sand in the lower levels of the dunes, binding them together and eventually producing a hard limestone rock, known as the Tamala Limestone. This limestone ranges in age from about 500,000 to 50,000 years.

Vegetation, which became established at the surface of the dunes, would have aided this process. Plant roots stabilised the surface and encouraged a more acidic layer of soil and humus (containing decayed plant and animal matter) to develop over the remaining quartz sand. The acidic soil accelerated the leaching process and a hard layer of calcrete formed over the softer limestone below. Over time, this limestone became harder, but in an uneven fashion. This was because parts of the original dune sand had been permeated by many plant roots, which tended to produce a harder limestone. Water seeped down cracks, which formed in the calcrete layer,

preferentially dissolving the slightly softer limestone. As this was leached away, the channels gradually filled with the insoluble quartz sand. This subsurface erosion continued until only the most resilient columns of the toughest limestone remained. The Pinnacles, then, are the eroded remnants of the formerly thick bed of limestone.

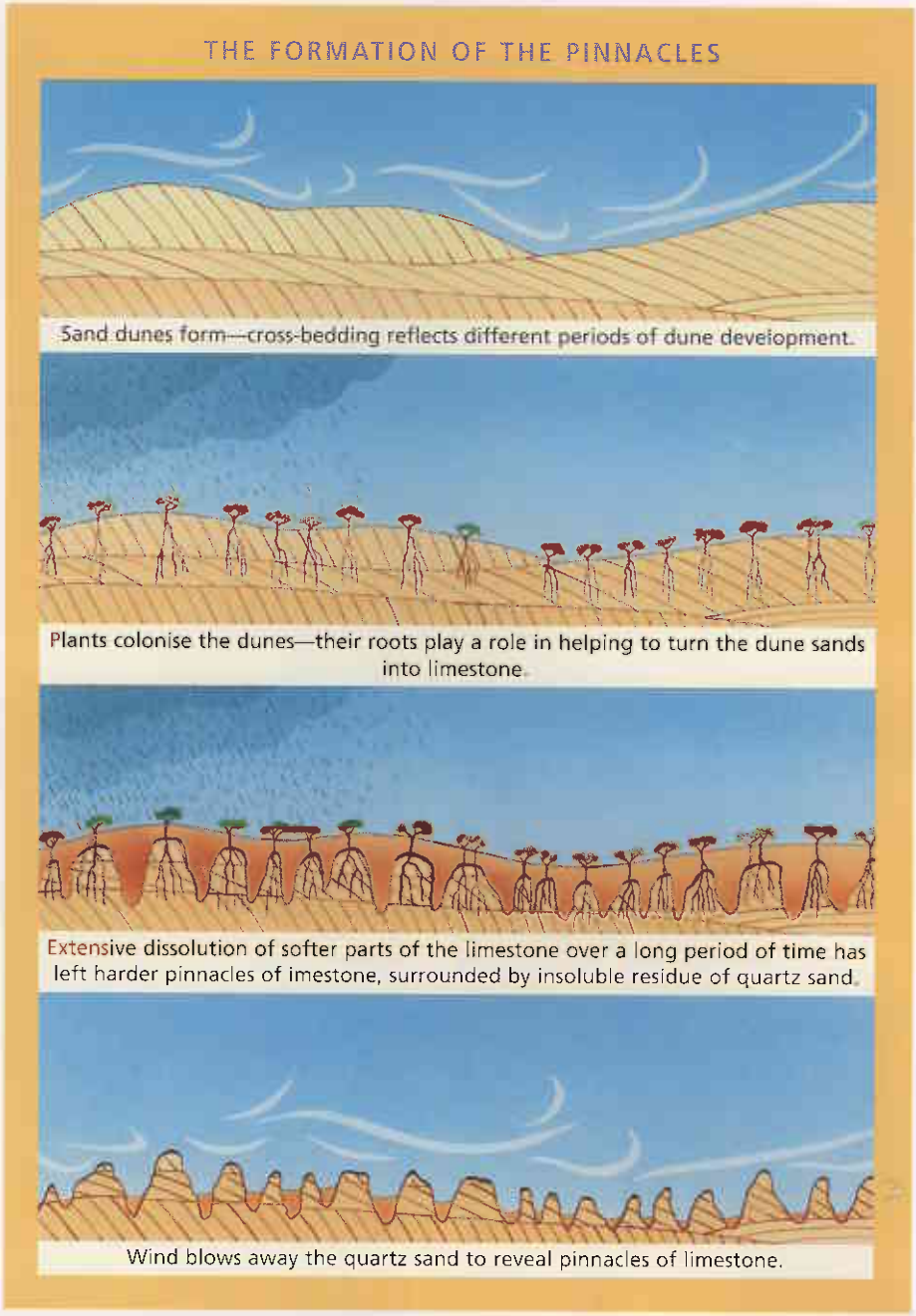
Periodic dry conditions during the last 25,000 years, exacerbated perhaps by bush fires, have resulted in the loss of vegetation cover. This has allowed winds to blow away the loose quartz sand, so exposing the limestone pillars. Some are only centimetres high and as thin as a pencil, others are glistening monoliths up to five metres high. More examples of pinnacles, but by no means so well developed, can be seen south of Nambung National Park; near Guilderton, near Lake Gnangara, near Bibra Lake, along the Swan River foreshore between Dalkeith and Peppermint Grove and near Mandurah.

FEATURES OF THE PINNACLES

Features in the Pinnacles that provide clues to their origin can be seen by astute observers. For example, many of the Pinnacles show cross-bedding, where the angle of deposition of the sand changes very abruptly. This indicates that the dunes, from which the limestone formed, were originally laid down by the wind. Windblown sand can be contrasted with sand deposited under water, which generally forms

Above: Egg-shaped structures, the fossilised pupal cases of a weevil, are present at The Pinnacles.
Photo – Ken McNamara

Right: Pinnacles come in all kinds of shapes and sizes. These low pinnacles have rounded tops due to their calcrete capping.
Photo – Len Stewart/Lochman Transparencies



horizontal layers. However, sand moved by the wind is laid down in front of moving dunes, which may slope very steeply. The windward side of the dunes will also slope at a much lower angle to the side that is sheltered from the wind. Thus, the limestone rocks reveal the direction of the prevailing winds thousands of years ago.

Another notable feature of the Pinnacles is that some of them look quite mushroom-shaped. The caps of the mushrooms are remnants of the calcrete capping mentioned earlier. The mushroom shape has formed because the capping is harder than the limestone below it, and it therefore weathers at a slower rate. This layer of very hard limestone formed at the interface between the soil and the dunes, where the calcium carbonate sand grains were subject to heavier chemical weathering than those beneath.

Fossilised plant roots, resembling petrified twigs, can also be seen in many places, such as the Pinnacles Desert. These were formed when plant roots provided an avenue for water moving downward. As the roots are quite acidic, this also encouraged the water to dissolve the sand and reprecipitate calcium carbonate around the roots, hardening the area immediately around them. These fossilised roots are known as rhizoliths, and are exposed when the wind erodes the softer sand around them.

Egg-shaped structures in the limestone were formed in a similar manner to the fossilised roots, and are actually the fossilised pupal cases of a

Top left: Some pinnacles are shaped like mushrooms due to their hard calcrete capping, which is harder than the limestone below.
Photo – Bill Bachman

Centre far left and centre left: Fragile fossilised plant roots can be seen in the Pinnacles Desert.

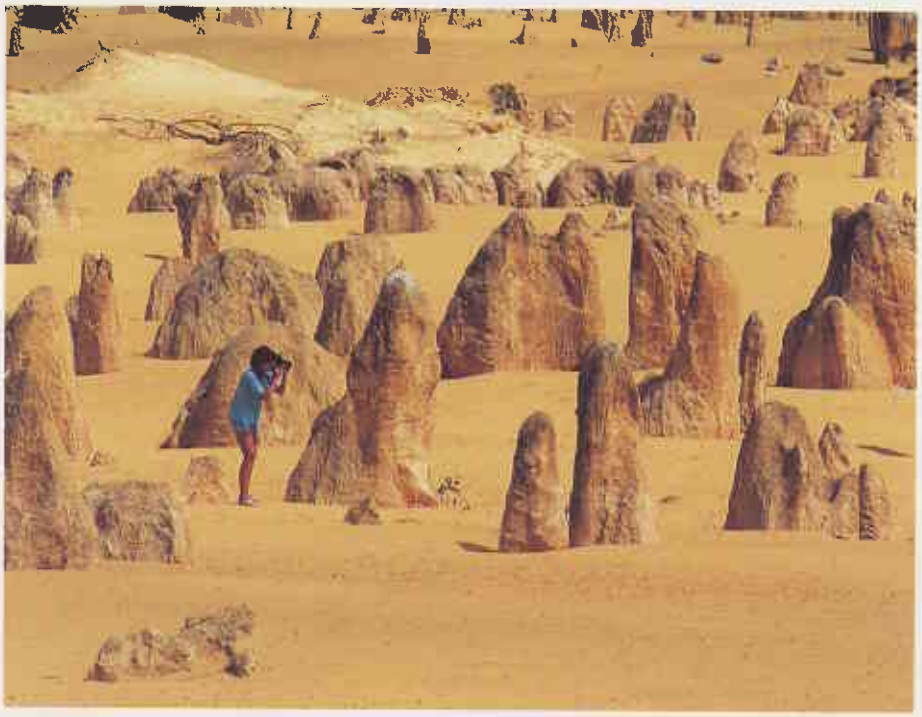
Far left: Less well-developed examples of pinnacles can be seen south of Nambung, such as this example near Mandurah.

Left: This pinnacle shows the influence of plant roots in promoting calcretisation of the limestone.
Photos – Ken McNamara

species of weevil. The beetle-like larva burrowed into the sand and then secreted a case around its body in readiness for metamorphosis. Once again, the higher acidity of these structures encouraged water to dissolve and secrete cement around the cases. The egg-shaped formations are hollow inside and some even have holes in one end from which the adult weevil emerged. They have since been exposed by erosion.

THE WINDS OF TIME

Although the formation of the Pinnacles would have taken many thousands of years, they were probably only exposed in quite recent times. Aboriginal artefacts at least 6,000 years old have been found in the Pinnacles Desert, despite no recent evidence of Aboriginal occupation being present. This tends to suggest that the Pinnacles were exposed about 6,000 years ago, and then covered up by shifting sands, before being exposed again in the last few hundred years. This process can be seen in action today, with the predominant southerly winds uncovering pinnacles in the northern part of the Pinnacles Desert but covering those in the south. Over time, the limestone spires will no doubt be covered again by other sand drifts, and the cycle repeated, creating weird and wonderful shapes over and over again.



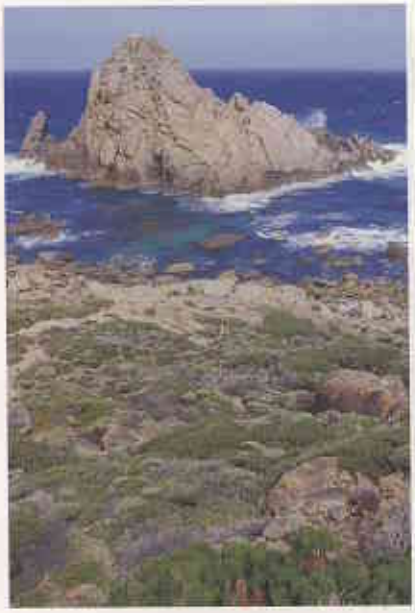
Top: The Pinnacles may have been exposed several thousand years ago, covered again by sand, then re-exposed in the last few hundred years.
Photo – Steve Sadler

Above: The Pinnacles are one of the best known landscapes in Australia, and draw more than 190,000 visitors each year.
Photo – Dennis Sarson/Lochman Transparencies

Ken McNamara is Senior Curator of Invertebrate Palaeolontology at the WA Museum. He can be contacted on (08) 9427 2755.

Carolyn Thomson-Dans is a Senior Projects Officer at the Department of Conservation and Land Management. She can be contacted on (08) 9389 8644 or by email (carolynt@calm.wa.gov.au)

The Pinnacles are a very popular attraction for many overseas visitors, with many hundreds visiting them every week. In addition, the area has been featured in a variety of art and other media. Find out more in 'Park' Antics on page 54.



Sugarloaf Rock is just one of the many features that make Leeuwin-Naturaliste National Park the most visited park in WA. (See page 10.)

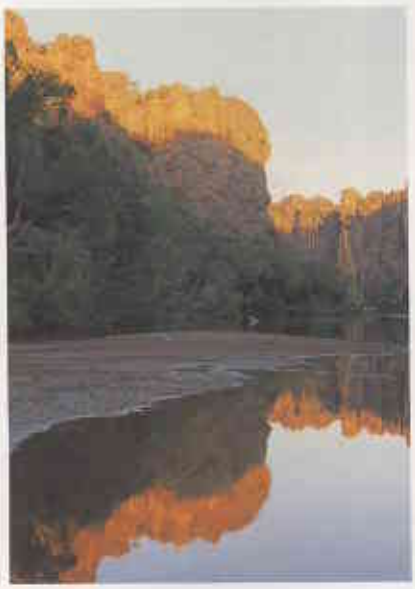
Winner of the 1998 Alex Harris Medal for excellence in science and environment reporting.

LANDSCOPE

VOLUME SIXTEEN NUMBER 1, SPRING 2000

Premier Park: John Forrest National Park is Western Australia's oldest park, celebrating its centenary year. (See page 22.)

Pinnacle of Parks: These unusual formations make Nambung National Park well known the world over. (See page 36.)



Windjana Gorge National Park holds important clues to the evolution of fish. See 'Old Fossils' on page 28.

William Bay National Park displays a miniature version of karri forest flora. (See page 42.)

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COVER

With 67 national parks spread across the State, park rangers are often the first contact that visitors have with the Department of Conservation and Land Management (CALM). Apart from providing visitors with information and guidance, they perform a vital role in the day-to-day management of their local environment.

Cover illustration by Gooitzen van der Meer, Western Australian artist and a graphic designer with CALM.

Executive Editor: Ron Kawalilak
Editors: David Gough and Carolyn Thomson-Dans
Story Editors: Caris Bailey, Mandy Clews and Verna Costello
Scientific/technical advice: Andrew Burbidge, Keith Morris, Paul Jones and staff of CALMScience Division
Design and production: Tiffany Aberin, Maria Duthie, Gooitzen van der Meer
Illustration: Ian Dickinson, John Long, Gooitzen van der Meer
Marketing: Estelle de San Miguel ☎ (08) 9334 0296 Fax: (08) 9334 0498
Subscription enquiries: ☎ (08) 9334 0481 or (08) 9334 0437
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