

Cosmic Impacts

in the Kimberley

When we think of arid land, we usually think of desert, rocks, spinifex, and other features of a waterless environment. But what do we see at night when we look up? John Goldsmith takes us on a double tour—of the Kimberley night sky, and of two ancient meteorite impact sites . . .

Story and photographs by John Goldsmith

Wolfe Creek meteorite crater, in the Kimberley in Western Australia's far north-east, is one of the most famous meteorite impact sites on Earth. Visitors from around the world are attracted to the crater to marvel at its spectacular size, and the superb views of the star-filled night sky offered by the remote location (see 'A Blast from the Past', *LANDSCOPE*, Spring 1996).

There is a second meteorite impact site in the Kimberley. Deep in the heart of the Purnululu National Park is an ancient circular feature known as the Piccaninny Circular Structure, believed to be the result of a meteorite impact 130 million years ago. Like Wolfe Creek, the site is protected by being enclosed in a national park, managed by the Department of Conservation and Land Management (CALM). Both sites provide a unique vantage to view the spectacular night sky of 'Outback Australia'.

Located about 130 kilometres south of Halls Creek, Wolfe Creek meteorite crater is accessed by the Tanami Desert Road, a gravel road that links Halls Creek to Alice Springs. The Tanami Desert Road can be rough and heavily



corrugated in places, and it is closed in the wet season. The journey is best undertaken with a four-wheel-drive vehicle. Following the turn-off from Tanami Desert Road to the crater, visitors first cross Wolfe Creek, which is completely dry in the dry season. Seen across the flat terrain, the crater first comes into view appearing as a low range to the east. The road ends at the base of the western wall of the crater, and a walk trail extends up to the rim.

WOLFE CREEK CRATER

The existence of the Wolfe Creek meteorite crater has been known to Aboriginal people for a very long time—nobody knows how long. The crater is known by the Jaru people as *Gandimalal*, and elders speak of the

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The stars swirl around the sky during a time exposure taken from within the Wolfe Creek meteorite crater bathed in moonlight.

Below: Wolfe Creek crater from the air reveals the central salt pan, distinctive vegetation and steep crater walls.

time when Jaru people first encountered it. They tended to spend most of their time near available water sources, such as the nearby Wolfe Creek. It appears that the less hospitable land where the crater is situated was less frequented by Jaru people; one story recalls the surprise of the first Jaru people when they saw the crater and its strange circular shape.

The crater was discovered by Europeans in 1947 during an aerial patrol. The remarkable circular formation was later inspected by a surveyor named Wolfe, thereby giving the name to both the nearby Wolfe Creek and the crater itself.

Astronomers speculate that the





Above: Zebra finches are among the animals supported by water from the crater's sinkholes.

Photo – Jiri Lochman

Right: Eucalypt trees cling to the side of the steeply walled crater.



crater was probably formed by an iron meteorite weighing millions of tonnes. The tremendous speed of the meteor on impact caused a massive blast, comparable to a nuclear explosion, resulting in a circular crater almost 900 metres in diameter and 150 metres deep.

In the 300,000 years since the impact, the process of erosion has slowly worn down the crater walls. Wind-blown sand and dust has partially filled the crater floor. However, the crater walls remain quite steep, and in places there are sheer cliffs, particularly on the inner side of the eastern crater wall. The walls presently stand about 40 metres above the surrounding flat plain, and the almost flat crater floor is 60 metres deep; about 20 metres below the surrounding plain. The outer portion of the crater floor is sandy, while the central portion consists of salt deposits. Sink-holes are located near the middle of the crater, and some water is present virtually all the year.

Although some small iron meteorite fragments have been discovered in the vicinity of the crater, very few particles of the original meteorite have survived. During the millennia that have passed since the impact, the meteorite has largely rusted away.

Adventurous visitors can explore

the crater by following a well-worn path from the car park to the crater rim, down the steep crater wall and onto the flat central area. A surprising feature of the crater floor is the presence of the paperbark tree (*Melaleuca lassiandra*), which would normally not grow in such an arid environment. This species does not occur on the surrounding plain, nor on the walls of the crater. It has survived from earlier times due to the micro-environment offered by the crater floor. The paperbark grows in a distinctively defined arc on the crater floor, midway between the crater wall and the central salty area.

Wattle trees (*Acacia ampliceps*) grow in a distinctive ring around the central portion of the crater floor, marking the boundary between the sand and salt deposits. Another species of acacia grows near the sinkholes in the centre of the crater. The life-giving water from the sinkholes also encourages kangaroos, dingoes and a variety of bird life, including the rainbow bee-eater and finches.

ABORIGINAL LEGENDS

Elders of the Jaru Aboriginal people refer to several stories about the crater. One well-known story deals with the passage of two rainbow snakes, which formed the nearby Wolfe Creek and

Sturt Creek as they crossed the desert. In the Dreaming, one snake emerged from the ground, forming the crater.

More recent research has recorded a story that relates to a star that fell from the sky and became buried in the ground, causing the crater to be formed. One day, the crescent moon and the evening star passed very close to each other. The evening star became so hot that it fell to the ground, causing an enormous explosion, flash, dust cloud and noise. This frightened the Jaru people, and a long time passed before they ventured near the crater to see what had happened. When they arrived at the crater, they realised they were at the site of where the evening star had fallen to the Earth. The Jaru people then named the place *Gandimalal*.

Interestingly, this story closely parallels our current understanding of crater formation by large meteorites (referred to as the 'evening star' which fell to Earth in the Jaru story). One Jaru elder indicated that this account was passed on from his grandfather's grandfather, which indicates that the story originates from before the first contact with white people.

Another story relates to the sinkholes in the centre of the crater. One day, a Jaru person entered the



Left: Emerging out of the dawn light spreading along the eastern rim of Wolfe Creek crater, an alignment of planets appears: first Mercury, then Saturn, Venus and Jupiter.

Centre left: The dramatic near-Earth approach of Comet Hyakutake only weeks after its discovery in 1996 is recorded in a photomosaic, showing the comet approaching the Earth over a 10-night period.

Below left: Wolfe Creek Crater is a unique place to observe the stars and meteor showers. John Goldsmith and James Athanasou set up camera equipment on the wall of the crater, ready for a meteor shower from Halley's Comet. A highly sensitive video camera records meteors during the meteor shower.



crater seeking water from the sinkholes. He entered a sinkhole, to discover a passage that went underground. After a considerable trek, he emerged into daylight at Wolfe Creek (which is actually located several kilometres to the west of the crater). It is said that because of the link from the crater sinkholes and Wolfe Creek, the crater floor never floods. This story is recounted with particular delight, noting the risk of snakes in the sinkholes and the darkness of the underground passage.

For the Jaru Aboriginal people, the dark and clear skies of the Kimberley have encouraged a remarkably intimate knowledge of celestial events. Jaru elders describe a rare phenomenon of meteors that cause sounds and vibration. Such events are known to occur when meteors cause sonic booms. Remarkably, this rare phenomenon is not only known to the Jaru people, but is even given the name *Gulungurru* to describe the sound.

CLOSE APPROACHES AND CELESTIAL IMPACTS

Wolfe Creek Crater is fascinating not only for its associated Aboriginal legends, but also for its international significance to astronomers and scientists. Noted US astronomers Carolyn and Eugene Shoemaker have undertaken many meteorite crater expeditions around the world, including Wolfe Creek Crater.



In 1993, the Shoemakers and US astronomer David Levy discovered a bizarre comet. Detailed images revealed that the comet was actually made up of many fragments, like 'pearls on a string', with a tail issuing from each fragment. Astronomers determined the orbit of the fragmented comet and discovered that it was on a collision course with Jupiter. Virtually every observatory in the world monitored the remarkable impacts of the comet fragments. Astonishingly, some impacts on Jupiter were about three times the size of our own planet!

Only two years after Comet Shoemaker Levy 9's impact with Jupiter, a new comet was discovered. Within five weeks of its discovery, Comet Hyakutake passed within 15 million kilometres of the Earth. The dramatic approach of the comet was seen from the dark skies of the Australian outback over several nights, culminating with the comet tail stretching across one third of the sky—a truly spectacular sight for those lucky enough to witness this rare visitor to the inner solar system. Fortunately, there was never any danger of a collision with the Earth, despite its close approach, but the comet reminded us that the Earth is exposed to the risk of massive impacts.

The dramatic comet impacts on Jupiter and the near-miss of Comet Hyakutake with the Earth preceded Eugene Shoemaker's last expedition to Wolfe Creek Crater, in 1997. Tragically, he was killed in a vehicle collision on the Tanami Desert Road during the expedition. Carolyn Shoemaker was injured in the same accident.

STRANGE FORMATIONS

To understand more about large impacts, scientists continue to search for evidence of scars on the Earth from

Above: The Purnululu National Park emblem shows the banded dome formations, the spinifex pigeon and a star-filled night sky.

Right: The Bungle Bungles provide a spectacular view from the air, with the narrow gorges and drainage patterns revealed in the vicinity of Piccaninny Gorge.

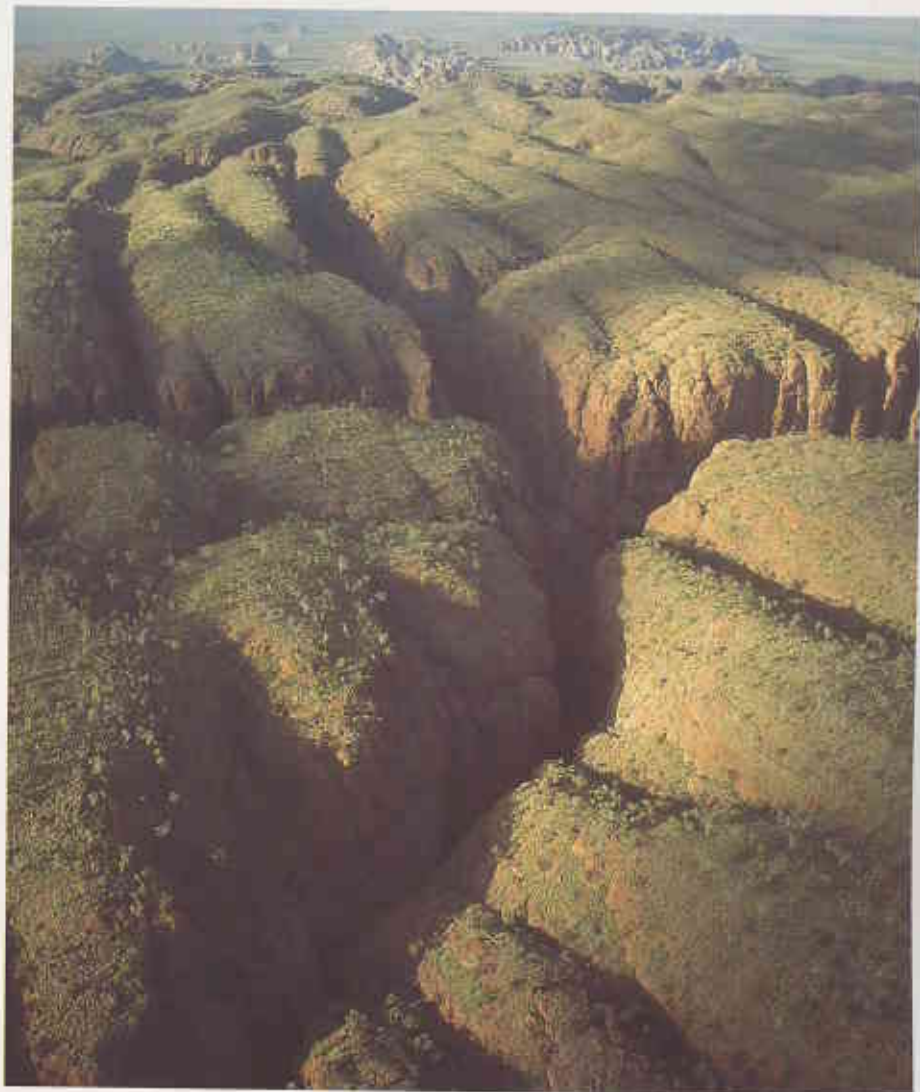


ancient meteorite impacts. One such scar has been discovered in the Bungle Bungle Range.

The Bungle Bungle Range, in Purnululu National Park, is located 150 kilometres north-east of Halls Creek. With the publicity given to the Bungle Bungles in the early 1980s by film maker Guy Baskin, and its part in the TV series *Wonders of Western Australia*, it could quickly be appreciated how

spectacular the characteristic Bungle Bungle 'dome' formations are. The remarkable banded sandstone and characteristically domed formations have made the Bungle Bungles instantly recognizable and a major attraction to overseas visitors.

Another feature, one that isn't immediately obvious, is the Piccaninny Circular Structure. This curious formation is located next to Piccaninny Gorge, in the heart of Purnululu National Park. The circular area is lower than the surrounding landscape and exhibits strange fault lines. The drainage patterns radiate out in a distinctive pattern, and Piccaninny Gorge itself changes course around the structure. The Piccaninny Circular Structure is an elliptical feature seven to seven-and-a-half kilometres across, with a centrally elevated section four kilometres across elevated by about 50 metres. The outer





Above: The Southern Cross and the Milky Way above the domes of the Bungle Bungle massifs.



Left: The Milky Way and other stars stand out boldly in the spectacularly dark skies above the Purnululu National Park.

zone of the structure comprises an encircling ring depression.

Sandstone in the central portion of the structure shows more fractures and folding, and has a greater content of silica than that outside. There is also a thin ridge of silicified sandstone

(sandstone impregnated with silica) at the south-eastern edge of the structure. The boundary of the circular structure also marks the end or change in direction of some fractures and vertical joints from the surrounding sandstone.

What could explain the formation? Scientists hypothesise that the formation was caused by an ancient meteorite impact 130 million years ago, resulting in an enormous crater. Erosion has worn the original crater away, but has now revealed the underlying deep impact scar.

The Piccaninny Circular Structure was initially recognised from satellite imagery, and the feature is perhaps best appreciated from the air. Visitors can view the spectacular Bungle Bungle dome-formations by helicopter (available at the national park), or light aircraft flights from Halls Creek or Kununurra. Flying over Purnululu

National Park is a spectacular way to see the formations, and also provides an opportunity to glimpse the mysterious and very large Piccaninny Circular Structure.

Both the Wolfe Creek Meteorite Crater and the Piccaninny Circular Structure in Purnululu are geological features of international importance and are protected by CALM-managed national parks. These remarkable cosmic impacts in the Kimberley provide us with the opportunity to better appreciate the night sky, meteorites, and our place in the cosmos.

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One of the best selling books from CALM has recently been fully revised. See 'The Best of the South-West' on page 10.



Satellite imagery is helping us to fight maritime pollution. See 'Looking Through the Surface' on page 41.



A new weapon against the scourge of feral cats was recently tested on Hermite Island. See 'Isle of Cats' on page 18.



In the far north of WA, there is evidence of not one, but two cosmic impacts. See 'Cosmic Impacts in the Kimberley' on page 28.



A unique network links volunteer groups and regional herbaria with the CALM flora database. See 'Name That Plant' on page 35.

COVER

Western Australia is aptly described as the Wildflower State. Some 12,500 different species are known from the wild, with a huge range of colours, shapes and characters. But many species once found are lost again, and it's always an event when a species thought to be extinct is rediscovered. See 'Lost Jewels in the Bush' on page 23.



Illustration by Philippa Nikulinsky

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