

# Uluru–Kata Tjuta National Park Note

## Geology

*The creation of Uluru and Kata Tjuta is explained differently by Anangu traditional owners and European scientists. This park note explains the processes from the perspective of a geologist.*

### What are Uluru and Kata Tjuta made of?

A quick close-up look at Uluru and Kata Tjuta will leave you in no doubt that they are made of different types of rock. Uluru rock is arkose, a coarse grained sandstone rich in the mineral feldspar. The sandy sediment which hardened to form this arkose was eroded from huge mountains composed largely of granite.

Kata Tjuta rock is a conglomerate. The conglomerate consists of gravel, pebbles, cobbles and boulders cemented by sand and mud. Most of the gravel pieces are granite and basalt, and makes the conglomerate look a little like a plum pudding.



Uluru (left) is arkose, a coarse grained sandstone rich in feldspar.

Kata Tjuta (right) is conglomerate made up of gravel pieces, granite and basalt.



### How and when were Uluru and Kata Tjuta formed?

Uluru and Kata Tjuta lie near the southern margin of an area called the Amadeus Basin. This depression in the earth's crust formed about 900 million years ago, and received layer upon layer of sediment over several hundred million years. Deposition of sediments in the basin stopped about 300 million years ago. At times the Amadeus Basin was a shallow sea. Sections of the basin were blocked from the sea and the water evaporated leaving crusted salt and a cold period left further deposits of glacial rock. The older sediments in the Amadeus Basin were crumpled and buckled about 550 million years ago in an event geologists call the Petermann Orogeny with mountain ranges uplifted during the latter stages of this event.

Bacteria and algae were the only existing life forms and they contributed to the breakdown of the rock and high, jagged mountain ranges. The bare mountains eroded easily with huge amounts of sediment washing away when it rained thus forming alluvial fans adjacent to the ranges. It is the remains of these alluvial fans we see today as Uluru and Kata Tjuta.

As the ranges eroded down, the building of the alluvial fans slowed and about 500 million years ago the region was again covered by a shallow sea in which many kinds of animals lived. As they died, they settled on the sea floor with sand and mud, gradually covering the alluvial fans.

The arkose and conglomerate layers, at least two and a half kilometres thick, were buried by fine silts and other sediments. These overlying sediments compressed and cemented the arkosic sand into arkose and the coarse gravels of Kata Tjuta into conglomerate.

The sea receded from the Amadeus Basin approximately 300-400 million years ago and the rocks were folded and fractured. This second major folding and faulting event is called the Alice Springs Orogeny. It raised the region above sea level and the horizontal layers of the Uluru arkose were folded and turned nearly 90 degrees to their present position.

The Kata Tjuta conglomerates tilted 15 to 20 degrees from the horizontal. As the folding process began, the surface rocks eroded at a rapid rate and beginning at a much higher level than the present tops of Uluru and Kata Tjuta, this erosion process lasted over 300 million years.

Uluru and Kata Tjuta are the visible parts of rocks which extend far beneath the ground. Uluru probably extends several kilometres below the surface and Kata Tjuta around five kilometres.

## What caused the interesting shapes of caves and patterns?

Knowledge of the sand blasting technique leads many to presume that the action of sand and wind formed the shapes of Uluru and Kata Tjuta. Scientists believe this is only partly true. Since sand is only raised a few metres during sand storms, it could only affect that small part of the rock near ground level. The sculptured shapes are more likely a combination of mechanical erosion and other events such as chemical changes caused by moisture.

The major valleys of Kata Tjuta may reflect fractures which formed during the Alice Springs Orogeny. Chemical weathering due to ground water widened these fissures and rain water runoff gradually formed the canyons we see today.

On many of the surfaces of Kata Tjuta you can see smooth pavements of cleanly cut boulders. These boulders previously protruded from the surface. Temperature changes caused them to expand and contract at a different rate to the parts of the boulder below the surface. When the tension became too much the rocks above the surface split smoothly away.

Unlike Kata Tjuta, there are no major joints and fractures visible in Uluru. Water erosion via rain runoff has formed the steep valleys with potholes and series of plunge pools in the arkose on the southern side of Uluru.

On the northwestern side weathering has produced parallel raised ridges outlining the sedimentary layers and the differences in the grain size or the strength of the cement have caused these variations.

The flaky surface of Uluru results from the chemical decay of minerals. The characteristic rusty colour of the exposed surface of these flakes is just that rust. It is caused by the oxidation of the iron in the arkose. The fresh arkose is greyish in colour.

## Underground water in the region?

Between Uluru and Kata Tjuta is an old valley now filled with sediment up to 100 metres thick. The sand layers in these sediments hold water which eventually seeps into Lake Amadeus.

Bores drilled into these sands provide water for the resort. The water table lies 25 metres deep near Kata Tjuta but shallows to 12 metres near the airport. It is slightly salty and is desalinated before use. Most of the water is new water having soaked in after recent rains, but some has been there for thousands of years.

## Do the sand dunes move?

The landscape the first Aboriginal settlers saw over 22,000 years ago looked much the same as it does now. Geologists have dated the sand of the dunes you see in the park today and have found that the dunes have remained in their present position for 30,000 years. However the crests of the dunes are looser sand and shift with the wind.

## Why do Uluru and Kata Tjuta appear to change colour at sunset and sunrise?

These colour changes have less to do with the geological make-up of the rock than with the effects the earth's atmosphere has on the sun's rays.

When the sun is low in the sky the atmosphere acts like a giant prism, splitting the sun's rays into a colour spectrum. The light reaching Uluru and Kata Tjuta near sunrise and sunset is mainly from the red end of the spectrum and its reflection from the rock and any clouds in the sky gives the spectacular colour. The reddish-brown colour of the rocks and surrounding sand enhance these effects.



Left to right - sunset and sunrise at Uluru



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