# Uluṟu–Kata Tjuṯa National Park Notes

# Geology

*The evolution of Uluṟu and Kata Tjuṯa is explained differently by the park's traditional owners and the European scientists. This park note explains the creation from the perspective of a geologist.*

**What are Uluṟu and Kata Tjuṯa made of?**

A quick close-up look at Uluṟu and Kata Tjuṯa will leave you in no doubt that they are made of different types of rock. Uluṟu rock is arkose, a course 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 Tjuṯa rock is a conglomerate. The conglomerate is gravel consisting of pebbles, cobbles and boulders cemented by sand and mud. Most of the gravel pieces are granite and basalt, and give the conglomerate a plum pudding effect.

Uluṟu (left) is arkose, a course grained sandstone rich in feldspar. Kata Tjuṯa (right) is conglomerate made up of gravel peices, granite and basalt.

**How and when were Uluṟu and Kata Tjuṯa formed?**

Uluṟu and Kata Tjuṯa 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 collecting sediments. 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 caused the break down 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 Uluṟu and Kata Tjuṯa.

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 2.5 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 Tjuṯa 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 Uluṟu arkose were folded and turned nearly 90 degrees to their present position.

The Kata Tjuṯa 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 Uluṟu and Kata Tjuṯa, this erosion process lasted over 300 million years.

Uluṟu and Kata Tjuṯa are the visible slabs of rock which extend down far beneath the ground. It is possible they extend down as far as five to six 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 Uluṟu and Kata Tjuṯa. 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 Tjuṯa may reflect fractures which formed during the Alice Springs Orogeny. Chemical weathering due to ground water widened these fissures and rain water run-off gradually formed the canyons we see today.

On many of the surfaces of Kata Tjuṯa 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 Tjuṯa, there are no major joints and fractures visible in Uluṟu. Water erosion via rain runoff has formed the steep valleys with pot-holes and series of plunge pools in the arkose on the southern side of Uluṟu.

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 Uluṟu 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 Uluṟu and Kata Tjuṯa 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 Tjuṯa but shallows to 12 metres near the airport. It is slightly salty and is desalinated before use. Geologists have dated the water and found ages range from modern to 7,000 years! Most of the water is modern having soaked in after recent rains.

**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 Uluṟu and Kata Tjuṯa 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 Uluṟu and Kata Tjuṯa near sunrise and sunset is mainly from the red end of the spectrum and its reflection from the rock and any clods 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 Uluṟu

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Director of National Parks

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