



SUNDOWN AREA

by Warwick Willmott

Sundown - just across the New England Highway from Girraween and its famous granite domes - offers completely different topography and scenery.

Incised rocky ridges, waterfalls at Red Rock Gorge, old mine sites and the gorge of the Severn River form a distinctive block of country with its own attractions. These are now protected within a National Park and Resources Reserve.

Why the difference from Girraween, and how did the scenery come to be here? The answer lies in the nature of the underlying rocks, and their history.

Geological framework

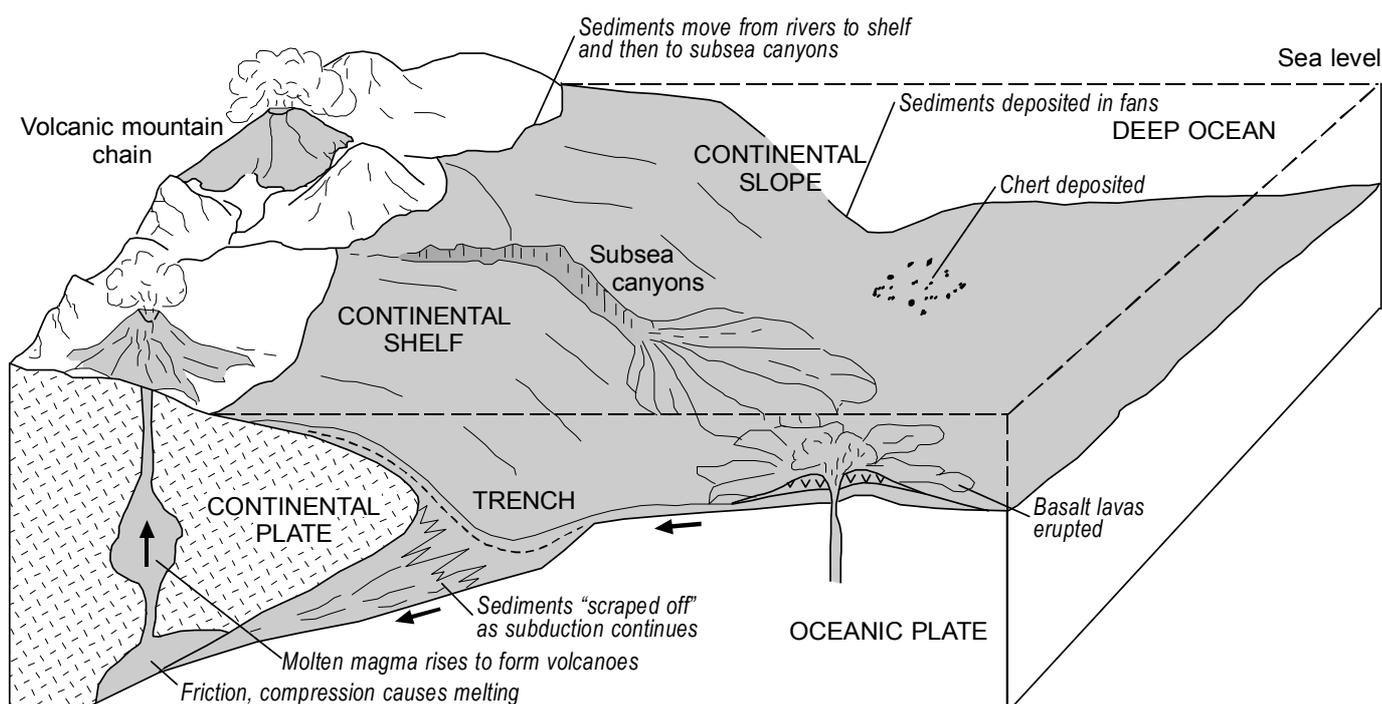
The Park and surrounds are underlain by two major rock units. The block of mountainous country with its stony ridges is formed primarily by hardened and deformed sedimentary rocks of the *Texas beds*. In Red Rock Gorge there is a small body of *Ruby Creek Granite* which gives more massive outcrops and cliffs. This has been responsible for the introduction of some minerals that have been mined on a small scale in the past.

Origins

1. What are the *Texas beds*? They are rocks which originated as sediments deposited in a deep-water trench to the east of the Australian continent, about 370-

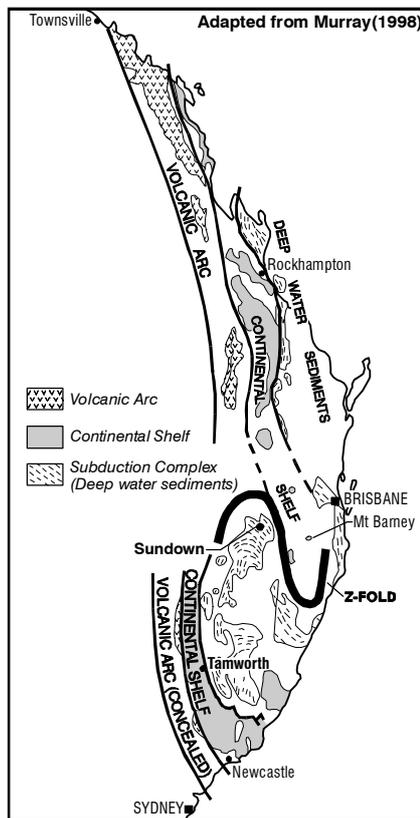
290 million years ago (in the late Devonian and Carboniferous periods). At that time the edge of the continent was an active volcanic mountain chain (somewhat similar to the present day Andes) with a continental shelf to the east, above a deep oceanic trench farther east again. All these were expressions of a "subduction zone" caused by the oceanic crustal plate being dragged westward beneath the continent (see figure).

Sediments eroded off the volcanic mountains were washed by rivers onto the continental shelf, from where they periodically slumped down sub-sea canyons into the deep trench. They were both fine muds and coarser sediments



Texas beds deposited in ocean trench east of continent 370-290 million years ago

composed largely of fragments of volcanic rocks. Some chemical deposits of silica (chert) and deep sea basalt lavas were also incorporated. Periodically these sediments were scraped off and compressed against the edge of the continent as the movement of the crustal plates continued.



Structure of the eastern side of the continent 370-290 million years ago

At the end of this subduction episode, the rock sequence was further compressed and uplifted to shallower depths or above sea level. The sediments were converted into hard "meta-sedimentary" rocks, chiefly argillite (from the muds) and greywacke (from the coarser sediments). The strata were steeply inclined from this compression.

The Texas beds are very similar to rocks of the same age and origin that occur between the Gold Coast, Brisbane and the Sunshine Coast hinterland (the Neranleigh-

Fernvale beds) but they are separated by rocks originally deposited in shallower water on the continental shelf to the west (exposed at Mount Barney).

Why do deep water rocks appear again this far to the west? This has been explained by a major fault which displaced the sequence laterally towards the end of the compression, episode, resulting in a Z-shaped mega-fold (see figure).

2. Towards the end of the mega-fold development in early Permian times (280-270 million years ago) there was some tension around its curves where small basins opened up. Sediments eroded off the Texas beds were deposited in shallow seas where shell fish and other marine life flourished. Further compression and uplift of the rocks occurred in a major episode in the Permian.

3. Sporadic volcanic activity and intrusion of associated granite magma at depth continued over parts of the eastern side of the continent throughout the late Permian and Triassic periods (from 250 to 230 million years). Although this activity postdates the deforming of the rocks of the trench/shelf system, it may have been the last expression of the subduction episode, with significant heating at depth generating considerable volumes of molten magma.

In the New England district, large masses of these magmas were intruded into the meta-sediments, solidifying into granitic rocks at considerable depths beneath the surface.

The extensive *Stanthorpe Granite*, which underlies the Stanthorpe and the Girraween areas, results from such activity in the Triassic period, about 240 million years ago. Slightly younger was the *Ruby Creek Granite*, which forms several smaller bodies that

intruded both the meta-sediments and the Stanthorpe Granite. One of these is exposed in Red Rock Gorge, and another forms Jibbinbar Mountain.

There appears to have been a period of major fracturing, possibly during intrusion of the granites, as there is an extensive set of fractures trending north-northeast cutting across Sundown (the Severn River Fracture Zone). Some magma was injected in extensive narrow sheets (dykes and sills) penetrating the older rocks along this zone.

Topography and landscape

Since the Triassic period, erosion has removed tremendous thicknesses of rock to reveal the granites of the district (these originally solidified at considerable depths in the crust). Where these granites are absent or at still greater depths, the meta-sediments remain.

The meta-sediments are relatively resistant to erosion and form rugged hilly to mountainous terrain. The north-northwesterly trending strata seem to have had only a minor effect on the development of the details of the topography. The major influence appears to have been the north-northeasterly trending Severn River Fracture Zone which has directed the course of the Severn River. Presumably the river originated at a higher level and has been forced to cut across the block of resistant strata rather than go around it.

Subsidiary creeks have been forced to drain into the Severn as best they can, but some exhibit a north-northwesterly trend which may be a reflection of control by the strata. Some waterfalls on the side creeks are caused by more resistant beds in the sequence.

Erosion of the valley of *Red Rock Creek* proceeded differently once the granite was unroofed. The more massive nature of the granite meant that erosion could only occur by chemical weathering along broadly spaced fractures, and by removal of the large intervening boulders. As a result cliffs developed in the massive rocks, including that of Red Rock Falls, which have retreated upstream only by undermining and collapse of large blocks. This is in contrast to the down-cutting of other valleys in the layered and fractured sediments, which are plucked out small piece by small piece.

The resistant rocks, both meta-sediments and granite, form shallow stony soils of only moderate fertility, and this combined with lower rainfall and a cooler climate than farther east results in drier vegetation types not seen elsewhere in southeast Queensland.

Local geology

In the Warwick - Stanthorpe district the Texas beds are locally termed "traprock". This is geologically incorrect, being an old English term referring to basalt volcanic rock, not meta-sediments.

The strata of the Texas beds in the stony ridges of Sundown are steeply inclined and mainly trend north-northwest. In detail they are chiefly dark grey, hard *argillite* with some coarser *greywacke*.

Two major dykes of *quartz feldspar porphyry* (essentially fine-grained granite) follow the northeast trend of the Severn River Fracture Zone; one forms the outcrop of Rats Castle.

On the summit of Mount Donaldson in the south of the Park some sediments of the early Permian shallow seas are exposed, lying on top of the Texas beds.

They are *breccias* and contain coarse fragments of older rocks and numerous fossils of shell fish.

In Red Rock Gorge we are seeing the very top of a body of the Ruby Creek Granite. The roof of meta-sediments is still present just above Red Rock Falls. It is only erosion by Red Rock Creek and its tributaries that has exposed the body to view. It is known to extend at depth farther to the south beneath the Sundown mines and the road to Burrows Waterhole, where it has been met in mine shafts and drill holes.

On the ridge above Burrows Waterhole there are bodies of dark *dolerite* and *gabbro*, which are probably intrusive sills (gently inclined dykes) from magma associated with the intrusion of the granite.

Mineral deposits

Small occurrences of tin, copper, arsenic, molybdenum and tungsten minerals have been located around Red Rock Gorge and places to the south. They are all related to the body of Ruby Creek Granite which is exposed in the gorge. This granite was the main mineralizing event in the Stanthorpe district, in contrast to the more extensive Stanthorpe Granite which was largely barren.

When a granite magma is solidifying, elements that cannot be accommodated in the crystal structures of the main minerals become concentrated in the final liquids and gases, which migrate to the roof of the intrusion. Some may then crystallize in the granite itself, or in quartz veins and fractures that penetrate the overlying and surrounding older rocks.

In Red Rock Gorge there are occurrences of molybdenite (molybdenum sulphide) in the top of the granite, and wolfram (tungsten oxide), copper and arsenic sulphides and cassiterite (tin oxide) in quartz veins above the granite. Similar veins

emanating from deeper levels of the granite form the deposits at the Sundown mines. On the track to Burrows Waterhole west of the Sundown mines, sets of fractures in the meta-sediments related to the Severn River Fracture Zone are lined with crystals of cassiterite, deposited from fluids emanating from the granite at depth.

History of mining

Lode (vein) tin in the form of cassiterite was discovered at the *Sundown Tin Mine* in 1893 and was worked sporadically until 1923, and again from 1953 to 1956. The mine was the biggest lode tin producer in the Stanthorpe district, which was mainly an alluvial tin field. Small amounts of tin were also produced from other prospects in the Red Rock area from 1893 to the 1930s, particularly from the *Carpenters Gully*, *Orient* and *Beehive Mines*. Most of the mines struggled because of the small lodes, difficult access and transport and lack of water.

Copper sulphides were worked on a small scale at the *Sundown Copper Mine* between 1888 and 1908, with some minor production until 1922, as well as at the nearby *Comet Mine*.

Arsenic was an important mineral in the early decades of this century, being used for poisoning prickly pear (then infesting large areas of Queensland), as well as in cattle dip and for hardening lead for bullets. A State Arsenic Mine was established in 1918 at *Jibbinbar* just to the northwest of the Park, adjacent to another body of the Ruby Creek Granite, to provide subsidised arsenic oxide to farmers. It continued until 1925 when cheaper arsenic became available from Japan. Arsenic ore (arsenopyrite) was also mined at the *Becroft Mine* from 1917 to 1927, the *Orient Mine* near Carpenters Gully (1918) and the *Sundown Copper Mine* (1922-1924).

Smelters to produce arsenic oxide from the arsenopyrite ore were erected at Jibbinbar, Sundown and Wallangarra. Contamination from arsenic oxide at the mines.

In the 1980's the cassiterite-encrusted fractures of the Severn River Fracture Zone west of the Sundown mines were identified treatment site on Little Sundown Creek and numerous open shafts have made it necessary to place the Sundown mines out of bounds to the public. Bushwalkers should not drink from Little Sundown Creek. below the by mineral exploration companies as a possible bulk low-grade tin prospect, but the overall percentage of tin was too low to be economic for the foreseeable future.

Further reading

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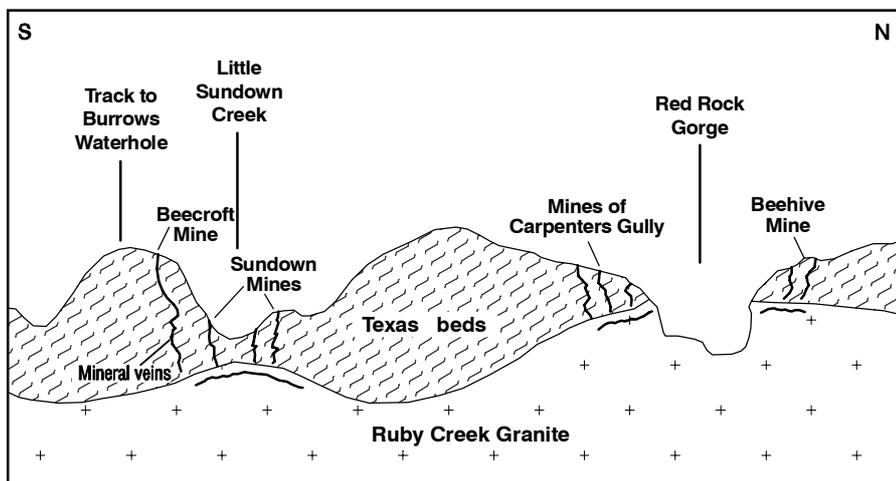
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Acknowledgements

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Cross section of mineral occurrences from the Ruby Creek Granite

