# Geology along the Brisbane Valley Rail Trail

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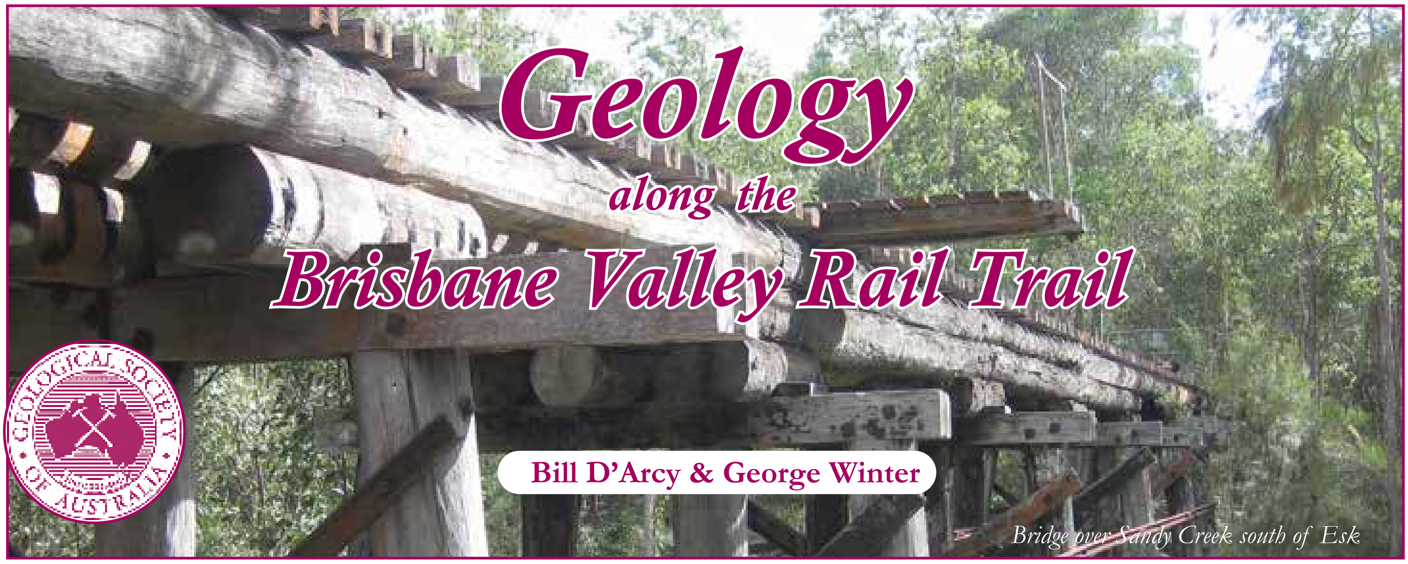


Bridge over Sandy Creek south of Esk

This leaflet describes interesting geological outcrops and features you can see when walking, biking or riding along the Brisbane Valley Rail Trail.

The description begins in the south at Wulkuraka just west of Ipswich and finishes at Yarraman.

A complete Geological Log of the Trail with GPS references can be found on our website at gsa.org.au.

## First, the geological setting

For much of its length the old railway passes over sedimentary rocks of the *Esk Formation*, which were deposited in the Esk Basin. This was an elongate depression that subsided and filled with sediments and volcanic rocks in the early to mid-Triassic period, about 240 to 230 million years ago. Its rocks are relatively soft, and have been eroded into a broad valley to form a convenient route for the railway and highway, as well as the Brisbane River. Ranges on either side are of harder rocks of much older age.

In many places these rocks were intruded by small bodies of magma of porphyritic andesite or microdiorite, about 135 million years ago in the Cretaceous period – the *Brisbane Valley Porphyrites*. Larger intrusions of resistant rhyolite forming Mount Glen Rock - Mount Esk may have been intruded earlier.

East of Benarkin the route crosses some of the older rocks to the west of the Esk Basin (the *Maronghi Creek beds*), which are from 370 to 310 million years old. Between Benarkin and Yarraman it also encounters volcanic rocks (the *Gilla Volcanics*) and granitic rocks cooled from molten magma (the *Taromeo Igneous Complex*), both of which originated at about the same time as the Esk Basin.

South of Esk, the Trail passes over later sandstones (of the *Woogaroo and Marburg Subgroups*) of the broad Clarence-Moreton Basin, an extension of the Great Artesian Basin. This slowly subsiding area collected sediments in latest Triassic to early Jurassic times, 210 to 190 million years ago.

The geology of much of the district is amplified in our leaflet *Rocks and Landscapes of the Esk District.*

## Wulkuraka to Fernvale ~ 22.7 km

This leg of the Trail passes over sedimentary rocks of the Clarence–Moreton Basin, but few are seen until the concrete subway beneath the Warrego Highway. Here a cutting exposes yellow-weathering sandstone, probably part of the *Raceview Formation,* a unit of the Woogaroo Subgroup. The sandstone contains white spots 1 to 2mm across, which are probably former feldspar grains, now weathered to clay (**Point 1**).

**Pt. 1. Exposure of Raceview Formation below the Warrego Highway overpass bridge.**

**Pt. 2. Exposure of weathered Gatton Sandstone, western side of the Trail.**

**Pt. 3. Panorama of cutting about 1 km east of Lowood in friable sedimentary rocks (Gatton Sandstone at the foot). Total height about 30 m. This cutting was set back about 10 m from the rails, so that minor landslides would not block the line.**

A few curves past the old Muirlea Station, past BVRT marker 006, two other cuttings expose weathered sandstone of the Raceview Formation. Past the BVRT 007 marker, a prominent sandstone outcrop on the west side of the railway represents the *Gatton Sandstone* (a unit of the Marburg Subgroup), which overlies the Ripley Road Sandstone (**Pt. 2**). Some of the rock here is so coarse-grained that the term 'sand' does not apply, the appropriate term is 'granules' (2 to 4 mm), so the rock type is a 'grit' (or granule conglomerate).

From here to Fernvale the route passes over the Woogaroo Subgroup (undivided) and the Gatton Sandstone, but few outcrops can be seen.

## Fernvale to Lowood ~ 8.5 km

After the Trail swings to the west away from Fernvale a gradually rising ridge on the left is underlain by the Gatton Sandstone, and thick alluvium of the Brisbane River can be seen to the right. The ridge rises to the summit of Mount Hancock which is composed of basalt, probably from a small volcanic plug. Hummocky ground on the ridge attests to past small landslips. The foot of Mount Hancock is so close to the Brisbane River that between BVRT markers 029 and 030 there is a high cutting (**Pt. 3**) on the south side of the railway, with exposures of grey sandstone of the Gatton Sandstone. The cutting face is potentially unstable, and remedial brickwork supports various sections.

## Lowood to Coominya ~ 11.8 km

Few rocks are exposed along this leg, which passes over weathered Gatton Sandstone and alluvium. There is a cutting in Gatton Sandstone about 2 km north of Lowood.

## Coominya to Mount Hallen ~ 14.1 km

This section of the route is on rocks of the Woogaroo Subgroup beneath the Gatton Sandstone. After the Logan Creek bridge the Trail rises to the northwest, and the terrain becomes more rugged with more cuttings in sandstones of the Woogaroo Subgroup.

Both planar-bedding and cross-bedding can be seen in the sandstone, the latter indicating deposition off the edge of sandbanks in a river.

**Pt. 4.** About 100 m before marker BVRT 057 at the crest of a rise, the south face of a cutting displays a spectacular example of 'soft-sediment deformation'. Such features are usually explained by disturbance (typically an earth tremor, or slumping down a delta face) of not-yet-solidified sediments near the water-sediment interface. Later sediment units may deform slightly as they settle on the underlying material.

The nearby peak of Mount Hallen is a remnant of 'Tertiary' basaltic lava flows and inter-flow sediments (now hardened to various sedimentary rocks).

**Pt. 4. Soft-sediment deformation in sandstone on south face of cutting. An upper thin-bedded unit overlies a unit with thicker bedding; boundary just above the hammer head.**

The resistant hills of the Mount Glen Rock–Mount Esk igneous intrusion on the eastern outskirts of Esk.

Mount Hallen is different from Mount Hancock southeast of Lowood, that being interpreted as a volcanic pipe or vent. Other peaks in the district may also be remnants of flows – Mount Mulgowie 6 km to the southwest, Balaam Hill 14 km to the south-southwest, and Mount Tarampa 17 km south-southeast.

## Mount Hallen to Esk ~9.4 km

Bedrock exposures along this leg, which crosses sandstones of the Woogaroo Subgroup, are rare. However 250 m beyond marker BVRT 058 sandstone in a cutting on the right (**Pt. 5**) shows a fracture plane, where 'slickensides' are displayed. These are scratches which are usually taken to mean that there has been movement on the fracture plane at some time.

As you approach Esk the striking hills of the *Mount Glen Rock –Mount Esk* igneous intrusion can't be missed to the east. This is an elliptical body (5 km by 4 km) of rhyolite that was intruded into the sedimentary rocks of the Esk Basin, apparently about 170 million years ago, although it is possible that some of the magma broke through to the then ground surface to erupt as lavas. The summit is about 350 m higher than the surrounding countryside at Esk. The rocks are resistant to weathering, and were eroded more slowly, so they stand above the more easily eroded Esk Formation and Woogaroo Subgroup.

## Esk to Toogoolawah ~19.0 km

Northwards from Esk we leave the Woogaroo Subgroup and progress across the older rocks of the Esk Basin, chiefly the *Esk Formation.*

After crossing the Esk-Kilcoy road, higher forested country to the north comprises hills of the Esk Formation which have been intruded by small bodies of the *Brisbane Valley Porphyrites*. These microdiorites are fine grained but with small crystals visible.

**Pt. 6.** After BVRT 073 and a timber bridge over Burnays Gully, the railway enters a cutting with weathered, medium to coarse sandstone of the Esk Formation in both walls.

After marker BVRT 075 the railway enters a series of cuttings with good exposures in the walls (**Pt. 7**). In one there is fine-grained Brisbane Valley Porphyrite on both walls of the cutting. This rock here is dark grey when fresh, but it weathers to a cream colour. Examples of spheroidal weathering can be seen – fist-sized lumps of rock are surrounded by shells of weaker, crumbly, more weathered rock about 5 mm thick. Weathering has begun along planar fractures, and progressed inwards, and was more concentrated at the corners and edges.

Small (1 to 3 mm) rectangular grains of feldspar are abundant in a dark grey much finer-grained groundmass. A two-stage cooling history is

Pt. 7. Brisbane Valley Porphyrite with 1-3 mm crystals in a finer groundmass. The rock also exhibits breccia texture.

Pt. 8. Pebbly sandstone in the east wall of a cutting, typical of the Esk Formation.

indicated – firstly slower cooling during which feldspar crystals grew in still-liquid magma, then a more rapid phase that froze the remaining liquid to fine grains before larger crystals could form.

At this location, and others elsewhere, the rock is a breccia, having been broken into fragments about 5 to 10 mm across, then reconsolidated into a hard, coherent rock.

**Pt. 8.** Grey, slightly-weathered pebbly sandstone in the east wall of a cutting further along represents the Esk Formation. The pebbles are mostly well-rounded, suggesting considerable abrasion during transportation from their source area, which was rich in rock such as quartzite, a common constituent of the pebbles.

**Pt. 9**. Where the Trail passes under the Brisbane Valley Highway bridge, westerly-dipping sandstone of the Esk Formation in the abutments is generally slightly-weathered to a tan colour; fresh grey unweathered rock can be seen in the southern abutment.

**Pt. 10.** About 350 m past the Highway bridge and marker BVRT 077 more of the Porphyrite is exposed in the walls of a cutting. Then after another 50 m the west side of the cutting exposes Esk Formation, mostly sandstone, but with some laminated shale beds. Fragmentary plant fossils are common in three shale beds in this stretch. A few metres further north again there is an intrusive contact between Esk Formation sandstone (south) and porphyrite (north). The intrusive process appears to have been forceful, as bedding in the sediments near the contact dips at 72° to the northwest, rather than the more typical 0° to 30° away from faults and intrusions.

Between the old Ottaba Station and Toogoolawah there is little rock exposure.

## Toogoolawah to Harlin ~15.0 km

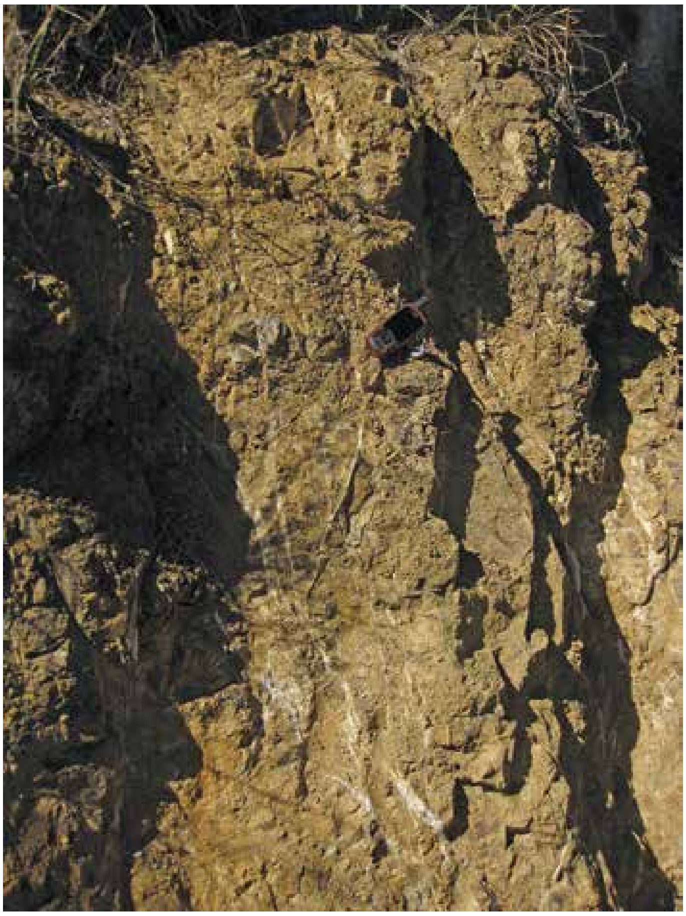
On this leg there are more exposures of the Esk Formation and several bodies of the Brisbane Valley Porphyrites.

Little is seen at first, but past the old Yimbun Station, the route rises into hilly country, with more exposures in cuttings. A little north of the 93 km post, cream-coloured porphyritic quartz microdiorite is exposed along 70 m of a cutting (**Pt. 11).** This intrusive rock is rich in plagioclase feldspar phenocrysts about 2 mm across, and grape-sized angular fragments of dark grey, fine-grained igneous rock are scattered throughout. The upper surface of the microdiorite is mostly parallel to bedding in the sandstone above so the intrusion may be a sill (a sheet of rock intruded parallel to bedding).

The route passes under the highway at the Yimbun Bridge where there is an exposure of sandstone from the Esk Formation. About 150 m past BVRT 095 a slightly curved bridge known as the 'Milk Train Bridge' was the site of a minor collision between two trains. More porphyritic microdiorite is exposed not far along. Between this bridge and the Yimbun Tunnel the Esk Formation contains some beds of shale, with inclinations to the northeast gradually getting steeper (**Pt. 12**). The Yimbun Tunnel is concrete lined but from the approaches it can be seen it was driven through sandstone of the Esk Formation. In the deep cutting on the northern end (**Pt. 13**) excellent examples of spheroidal weathering can be seen in the sandstone.

**Pt. 12. Steeply inclined sandstone-shale sequence between 'Milk Train Bridge' and Yimbun Tunnel.**

**Pt. 13. Spheroidal weathering in thick sandstone of the Esk Formation in the cutting north of Yimbun Tunnel.**



Pt. 14. Brown-weathering sandstone of the Esk Formation under the northern end of the Nurinda Road bridge north of Harlin. Calcite veins up to 20 mm thick are common.

To the east can be seen the currently active Karraman's Quarry, which supplies crushed rock from a body of microdiorite for various construction purposes, including the culverts and surfacing of the Rail Trail.

## Harlin to Moore ~13.4 km

Where the Trail passes under Nurinda Road, 400 m past BVRT 106, brown-weathering sandstone (Esk Formation) is exposed in the cutting below the north abutment (**Pt. 14**). White carbonate veins (most likely of calcite) up to 20 mm wide cut the rock; they were probably deposited from fluids when the rocks were compressed and folded. Spheroidal or onion-skin weathering in the sandstone is again common.

In a cutting about 400 m beyond Nurinda Station (**Pt. 15**), bedding in sandstone of the Esk Formation dips in several different directions. Folding of the beds on a small scale is implied by this local variability.

## Moore to Linville ~6.3 km

North of Moore the Trail follows the road for a while before re-joining the old railway formation. About 50 m past BVRT 116 (**Pt.16**) cuttings expose sandstone and pebble conglomerate of the Esk Formation. About 100 m past BVRT 119 the Trail crosses Linville Road and more such rocks are seen in two cuttings.

Pt. 16. Pebble conglomerate (Esk Formation) north of Moore.

## Linville to Benarkin ~18.0 km

This steep section of the Trail exposes many examples of the sedimentary rocks of the Esk Formation. About 400 m north of Linville Station at the Anna Street road bridge the abutments show laminated grey shale (**Pt. 17**). About 10 m north of the bridge bedding in the western cutting face dips steeply west, but steeply east in the eastern side; the combination suggests an arch-shaped fold or anticline, with steeply-dipping flanks (called limbs). The central or core section of the fold has disappeared with the excavation of the cutting.

**Pt. 18.** About 200 m beyond a gate opposite the Linville sawmill a low cutting exposes dark grey laminated shale and mudstone. About 150 m farther west pebbly sandstone and conglomerate are exposed in a low bank on the south side of the Trail. This variation in rock type is reflected in the name of the stratigraphic unit (Esk Formation); no single rock-type predominates over the whole area of occurrence.

**Pt. 19.** Near the 121 km post sandstone displays onion-skin or spheroidal weathering, with fresher near-spherical core-stones surrounded by more-weathered layers about 5 mm thick. The low ridges running downhill towards the Trail from the south are called strike-ridges, and reflect variations in the resistance to erosion caused by minor variations in rock-type. After the next gate, the rocks are mixed shale, sandstone and pebble conglomerate (still Esk Formation), dipping moderately to the west here rather than the east. The rocks are gently folded on this stretch of the Trail, with a wavelength or spacing that is too big to see in any one cutting; the variation shows up at a larger scale, from cutting to cutting.

Landslides are common along this steep section of the Trail, and can be seen on the opposite slopes of Blackbutt Creek.

**Pt. 20. Fossils of plant fragments in a boulder of pebbly sandstone.**

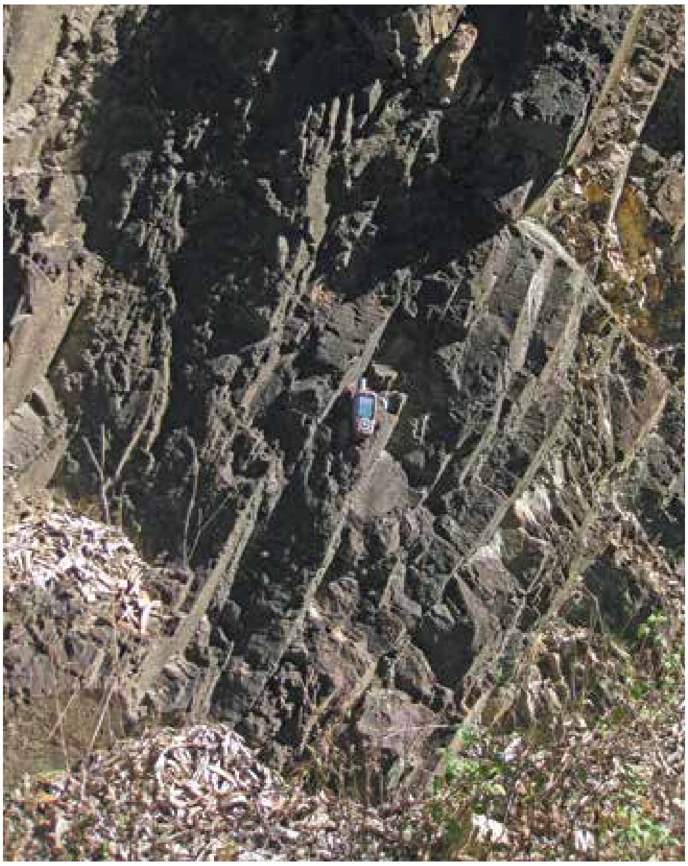
More cuttings exposing sandstone and some shale of the Esk Formation continue past the old Macnamara's Camp site to a bridge beneath the D'Aguilar Highway. At one crossing of Blackbutt Creek a boulder on the left contains plant fossils that look like elongate leaves or stems (**Pt. 20**).

About 900 m beyond the highway bridge, the Trail leaves the Esk Basin, and passes onto much older basement rocks to the west, but outcrop is poor. Quartzite in one cutting is consistent with Maronghi Creek beds, one of these older units, but rocks of the Taromeo Igneous Complex appear more common. At a sharp curve just after a shelter shed and bench seats there is a large concrete culvert underneath the embankment. About 100 m beyond the culvert (**Pt. 21**), a typical exposure of Maronghi Creek beds, of a hardened fine-grained sediment (meta-sediment), can be seen in the cutting.

Beds of breccia can be seen in a cutting about 450 m further west (**Pt. 22**). About 150 m past the breccia at BVRT 135 the route passes from timbered country into a clearing. Around the left-hand bend after the clearing the route reaches *laterite,* which has formed in a deeply weathered soil profile (**Pt. 23**). Laterite commonly develops in areas of warm weather with distinct rainy and dry seasons (typically monsoon climates).

Rainfall saturates the weathered rock and leaches metal ions out, but dry periods allow the iron and aluminium to precipitate as very insoluble oxides and hydroxides of these metals. These minerals commonly precipitate near the ground surface as round brown nodules called pisolites, commonly from 5 to 15 mm in diameter. Sometimes the pisolites are loose and separated, otherwise they may bind together as a hard layer or *duricrust* commonly less than 1 m thick.

Beneath the shallow pisolite layer is mottled clay sometimes up to 5 m thick. The mottles are often decimetre-sized patches of brown material rich in iron oxide scattered through softer pale clay (grey, cream or white). The mottled layer is generally below the water table, and typically stays soft. Underlying the mottled zone is weathered bedrock. The laterite here is



**Pt. 21. Typical Maronghi Creek beds with prominent joints.**

**Pt. 22. Matrix-supported breccia, Maronghi Creek beds.**

a former soil or "paleosol", suggesting a past climate with distinct wet and dry seasons.

For the next few kilometres the Trail is in a continuous cutting a few metres deep exposing mainly the laterite profile, but there are a few exposures of bedrock (Maronghi Creek beds) at the toe of the cutting.

### Benarkin to Blackbutt ~4.6 km

Exposures along this short section are mainly in the laterite.

### Blackbutt to Cooyar Creek ~11.0 km

Along this section you can see exposures of granitic rocks of the Triassic Taromeo Igneous Complex and the Gilla Volcanics. Magma of granitic composition solidified deep in the subsurface to form coarse-grained rocks like granite and granodiorite, but part of the magma reached the surface and was extruded as volcanic rocks (Gilla Volcanics) such as rhyolite, which has a similar composition to granite. The Trail moves back and forth over the two rock units.

From Blackbutt the Trail commences on laterite, probably developed over granitic rocks, but granitic soil rich in grains of quartz, feldspar, and the dark mica mineral biotite that twinkles in the sunlight, can be seen in a low cutting about 2 km from Blackbutt. Weathered granite is revealed in a low cutting on the left about 300 m past a farm access road (**Pt. 24**).

About 40 m past this granitic rock, a cutting on the right side exposes a pale, layered fine-grained rock that is most likely rhyolite from the Gilla Volcanics (**Pt. 25**). More exposures of these volcanic rocks can be seen in a cutting on the left 100 m beyond the sign commemorating the tennis player Roy Emerson.

**Pt. 26. Inhomogeneous granitc rock (Taromeo Igneous Complex). Right of the GPS unit is a xenolith (fragment) of high-grade metamorphic (a gneiss). Near the right edge of the photo is a dark grey enclave of a fine-grained igneous rock (probably microdiorite). The pale pink area towards the right on the bottom edge of the photo is a vein of aplite.**

The next cutting, starting about 150 m past the old Nukku Station site, exposes granitic rocks to beyond the Nukku Bridge across D'Aguilar Highway (**Pt. 26**). The granitic rocks are not homogeneous; they contain fragments of fine-grained igneous rocks, pieces of metamorphic rocks with layering imposed during deformation, and thin veins of aplite. Aplite is a late stage part of the magma, formed after the bulk of it has almost fully crystallized; the solidified magma can crack, and the remnants of still-liquid material can flow into these cracks. Aplite is a fine-grained rock rich in feldspar and quartz and poor in dark iron-magnesium minerals.

Under the highway bridge a dark grey basaltic dyke (magma-filled fracture) cuts the granitic rocks (**Pt. 27**). This dyke may have fed basaltic lava to the surface.

A few metres beyond the bridge the north face of the cutting shows a contact (junction) between Taromeo Igneous Complex granitic rocks and rhyolite of the overlying Gilla Volcanics (**Pt. 28**). The age relationship here is not definitive. The bulge of the granitic rocks towards the rhyolite suggests intrusion of granitic magma into already solidified rhyolite. There is a similarity in chemistry and age of the two rock types that suggests they are portions of the same magma body – some material was extruded as the Gilla Volcanics, and some crystallised in the subsurface as

**Pt. 27. Dark grey basalt dyke (left) intruding granitic rocks of the Taromeo Igneous Comlex under the Nukku Bridge.**

Pt. 28. Contact between granitic rock (Taromeo Igneous Complex) and overlying rhyolite (Gilla Volcanics).

the granitic rocks of the Taromeo Igneous Complex. Cuttings further west expose brown-yellow weathered granite.

About 1.5 km past the highway bridge, just after a creek crossing, a feature in the left side of the cutting looks like a rough stone wall (**Pt. 29**). This is a fractured (or jointed) aplite dyke in strongly weathered granitic rock. The aplite is less weathered than the granitic rock, and harder, so it was left standing proud when the cutting was excavated. Gilla Volcanics are exposed in the western end of this cutting but about 600 m beyond the dyke granitic rocks are exposed again in shallower cuttings over the next kilometre.

About 500 m past the old Gilla Station the Trail passes under the D'Aguilar Highway at the Gilla Bridge. Good exposures of the Gilla Volcanics are seen in the cuttings here (**Pt. 30**). The route descends to Cooyar Creek on these rocks but they cease to be well exposed.

## Cooyar Creek to Yarraman ~7.6 km

Granitic rocks of the Taromeo Igneous Complex are well-exposed about 100 m beyond Cooyar Creek on the north side of the route (**Pt. 31**). Weathered granite is common beyond the old Pidna Station, with fresh, jointed granite in a cutting about 600 m beyond the station site (**Pt. 32.**)

About 1.2 km beyond Pidna a cutting exposes granitic rocks (Taromeo Igneous Complex) on the right hand face, and fine-grained rhyolitic rock (Gilla Volcanics) in the left face of the cutting (**Pt. 33**). The contact is not exposed, so we cannot say definitively whether it is intrusive (granite younger than volcanics), or non-conformable (younger volcanics sitting on the eroded top of an older granitic body). There is vague vertical banding in the volcanic rock that appears to be flow-banding.

Pt. 33. Rhyolite of the Gilla Volcanics with sub-vertical banding that seems to be flow-banding. The rock has small angular cavities that appear to be weathered-out former crystals, rather than vesicles (gas-bubble cavities).

About 10 m to the north the right-hand face of the cutting displays a fine-grained volcanic rock alongside coarser granitic rock (**Pt. 34**). The contact is planar, and intruded by a thin quartz vein, so once again the age relationship is equivocal. There are poor exposures of volcanic rocks for a few more hundred metres, including a matrix-supported breccia.

About 350 m past a gate and grid you reach a large granite boulder (indicating the Taromeo Igneous Complex). About 100 m farther on porphyritic andesite in both cutting faces indicates a return to Gilla Volcanics, but after another 500 m granite is exposed again in a low cutting on the right side of the Trail. There appear to be no more exposures of Gilla Volcanics from here to Yarraman.

Towards Yarraman the route passes into a wide, shallow cutting in strongly weathered granitic rock, with a mottled zone developed at the base and a ferruginous duricrust at the top; this is a laterite profile (**Pt. 35**). Below the laterite profile is moderately-weathered granite displaying spheroidal or onion-skin weathering. A little beyond this point there is a contact going from granite to aplite, and after 25 m the matching contact of aplite back to granite.

There is little of further geological interest from here to Yarraman.

Edited by Warwick Willmott