Lower Ginninderra Creek Geology

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The following notes are derived from the scientific literature on the geology of the lower Ginninderra Creek and surrounding region just to the north of the Australian Capital Territory.

Reference material

The following reference material is appropriate for the area of interest:

Owen, M. and Wyborn, D., 1979. Geology and geochemistry of the Tantangara and Brindabella 1:100,000 sheet areas; New South Wales and Australian Capital Territory. Bureau of Mineral Resources, Geology and Geophysics, Bulletin 204.

Abell, R. S., 1991. Geology of the Canberra 1:100,000 sheet area, New South Wales and Australian Capital Territory. Bureau of Mineral Resources, Geology and Geophysics, Bulletin 233.

Finlayson, D. M. (author and editor), 2008 – A Geological Guide to Canberra Region and Namadgi National Park. Co-authors – R. S. Abell, D. L. Strusz, P. Wellman, M. J. Rickard, D. Clark, K. McCue, K. S. W. Campbell, K. G. McQueen and B. Pillans. Geological Society of Australia (Australian Capital Territory Division), Canberra, 140 pages.

Strusz, D. L., 1971. Explanatory notes on the Canberra Geological Sheet SI/55-16; scale 1:250,000. Bureau of Mineral Resources, Geology and Geophysics.

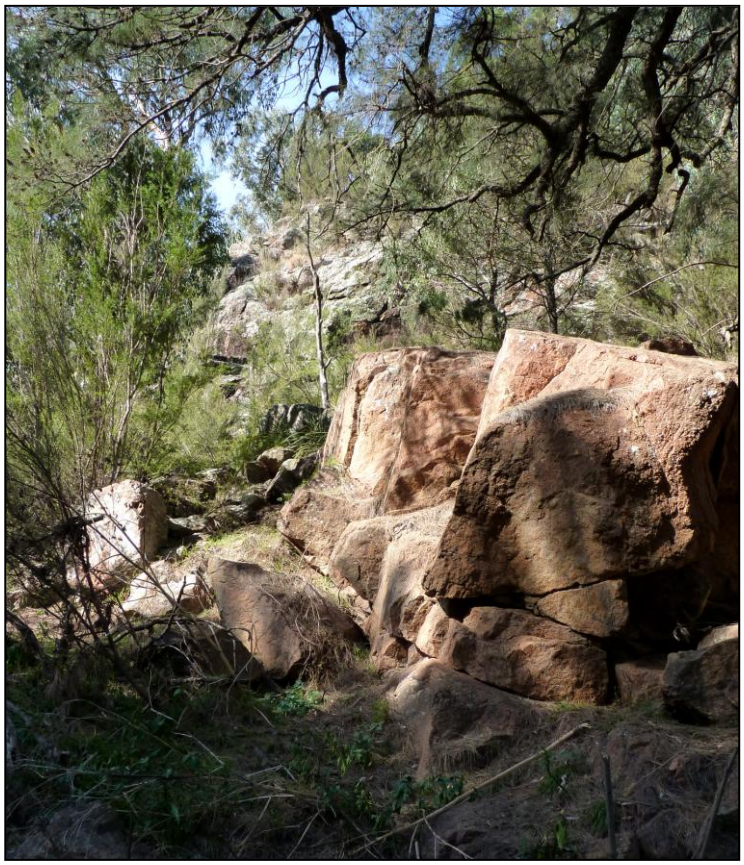
An extract of the Owen & Wyborn (1979) 1:100,000 geological map is attached showing the principal geological units mapped in the area of interest. Also attached are an extract from the 1:25,000 scale topographic map of the area, the Umburra Sheet 8627-1S, an extract of the aerial photography depicted on the reverse side of the Umburra Sheet, and a Google Earth image of the area of interest.

Simplified description of the principal rock units within the area of interest.

- The area as a whole is dominated by elements of ***two volcanic suites*** of igneous rocks recognised throughout the whole Canberra region – the ***Hawkins Volcanic Suite*** aged about 428-424 million years (Ma), and the slightly younger ***Laidlaw Volcanic Suite*** aged about 424-422 Ma. These suites are both within the Silurian geological period (444-419 Ma).

Laidlaw Volcanic outcrop along the Murrumbidgee River near the Wallaroo Road downriver from Ginninderra Creek.

- Both suites of volcanic rocks are deeply ***eroded remnants of a Silurian arc of volcanic centres*** that dominated eastern Australia 400+ million years ago. These volcanic centres were surrounded by shallow seas at that time as is evident by the many limestones and associated fossils evident in outcrop farther down the Murrumbidgee River near Wee Jasper and at the Cotter Recreation Area farther upriver. The tectonic environment was much like we now see around the Philippine Islands.
- Rock units within the ***Hawkins Volcanic Suite*** mapped in the area of interest include the ***Walker Volcanics*** (Svw) and the ***Paddys River Volcanics*** (Pv1). Both units are described on the attached geological map extract. As is evident from volcanic eruptions today, volcanic rocks can generally be of many different types from very light pumice that floats on water to very dense and hard ashstone and ignimbrite such as that seen on the summit of Mount Ainslie. Diversity is to be expected.



Ginninderra Porphyry outcrop, an intrusive igneous rock unit near the Murrumbidgee River.

Lower Ginninderra Creek Geology
Extract from the 1:100,000 scale Brindabella Geology Sheet 8627, 1979.

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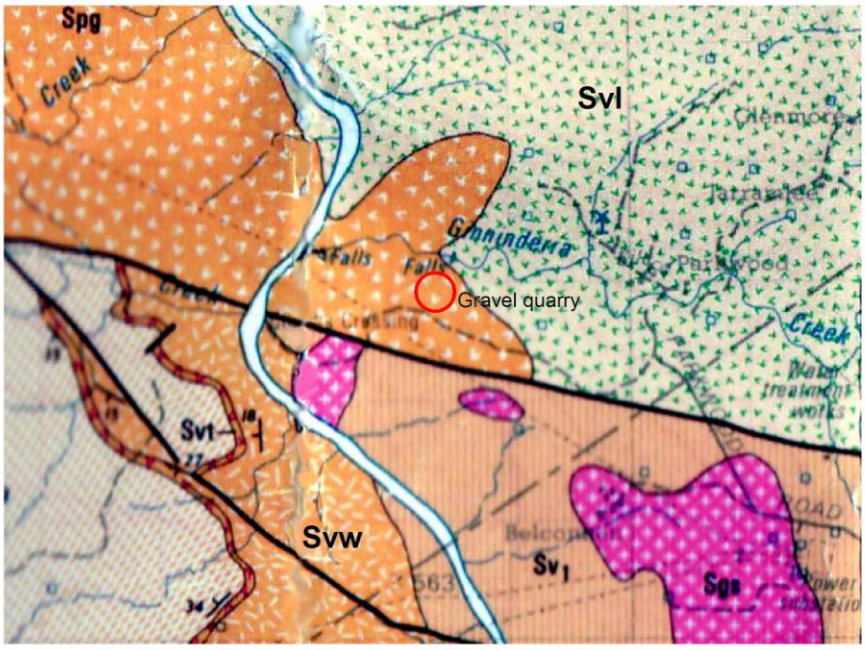
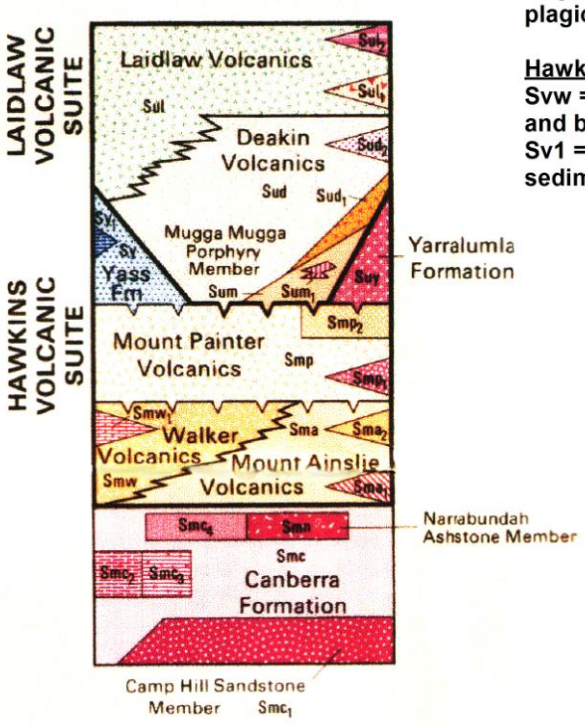


Sgs = Quartz-feldspar porphyry, adamellite, granodiorite (about 416 Ma)

<u>Laidlaw Volcanic Suite</u> (424-422 Ma)
Svt = Tarpaulin Creek Ashstone member : fine-grained bedded ashstone
Svl = Laidlaw Volcanics : dark to light grey porphyritic rhyodacite ignimbrite
Spg = Ginninderra Porphyry ; red porphyry with quartz, plagioclase and mafic phenocrysts

<u>Hawkins Volcanic Suite</u> (428-424 Ma)
Svw = Walker Volcanics ; green to purple dacite ignimbrite and bedded tuff
Sv1 = Paddys River Volcanics : interbedded volcaniclastic sediment, dark grey ignimbrite. agglomerate and tuff



- Rock units of the ***Laidlaw Volcanic Suite*** within the area of interest include the ***Laidlaw Volcanics*** (Svl) themselves, the intrusive ***Ginninderra Porphyry*** (Spg) and, to a small extent, the ***Tarpaulin Creek Ashstone Member*** (Svt).
- The **Laidlaw Volcanics** (Svl) are remarkably uniform in appearance and compositions (Owen & Wyborn, 1979). They are formed almost exclusively of a medium grey rhyodacite deposited during subaerial ignimbritic eruptions (424-422 Ma).

Ginninderra Porphyry, an intrusive rock quarried near Ginninderra Falls as gravel for urban gardens and pathways.

- The **Ginninderra Porphyry** is a high level stock that intrudes into the Laidlaw Volcanics. It is considered to be the intrusive equivalent of the Laidlaw Volcanics and is chemically similar. It is referred to as a porphyritic microgranite by Owen and Wyborn (1979). It is now quarried to provide an attractive red-coloured gravel for urban gardens and walkways. Although the gravel is often referred to commercially as a “red granite”, the rock in the strict geological sense is not a “granite” - geochemists refer to it as a dacite or albitised dacite (where albite has replaced some components of the original dacite from a centre of volcanism). It is evident in outcrop along the Murrumbidgee River where it cuts through the rock unit. Columnar jointing is well developed in the gorge of Ginninderra Creek between the upper and lower waterfalls. Columns reach a height of 30 metres with a diameter of about 1 metre (Owen and Wyborn, 1979)

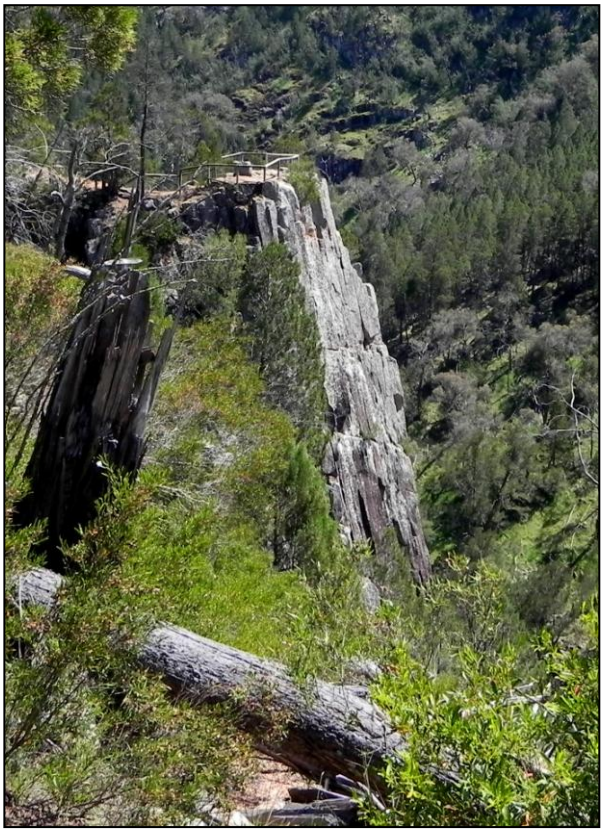
Upper Ginninderra Falls and outcrop of Ginninderra Porphyry.

Note columnar structures.

- ***Granite*** igneous rocks intruded into the area later in geological time, about 416 Ma, after the active volcanism across the region had died down. The locations of the granite outcrops are shown on the accompanying geological map (Sgs). They are not given a specific name. There are good outcrops of the granite along the Murrumbidgee River. The granites were intruded at significant depths within the Earth's crust, possibly as deep as 5 km, thus giving some idea of the amount of denudation that has occurred across the region since their emplacement. Hence geologists refer to the ***"deeply eroded landscape"*** across the Canberra region.

Siluro-Devonian granite outcrop along the Murrumbidgee River about 1.5 km upriver from where Ginninderra Creek enters the river.

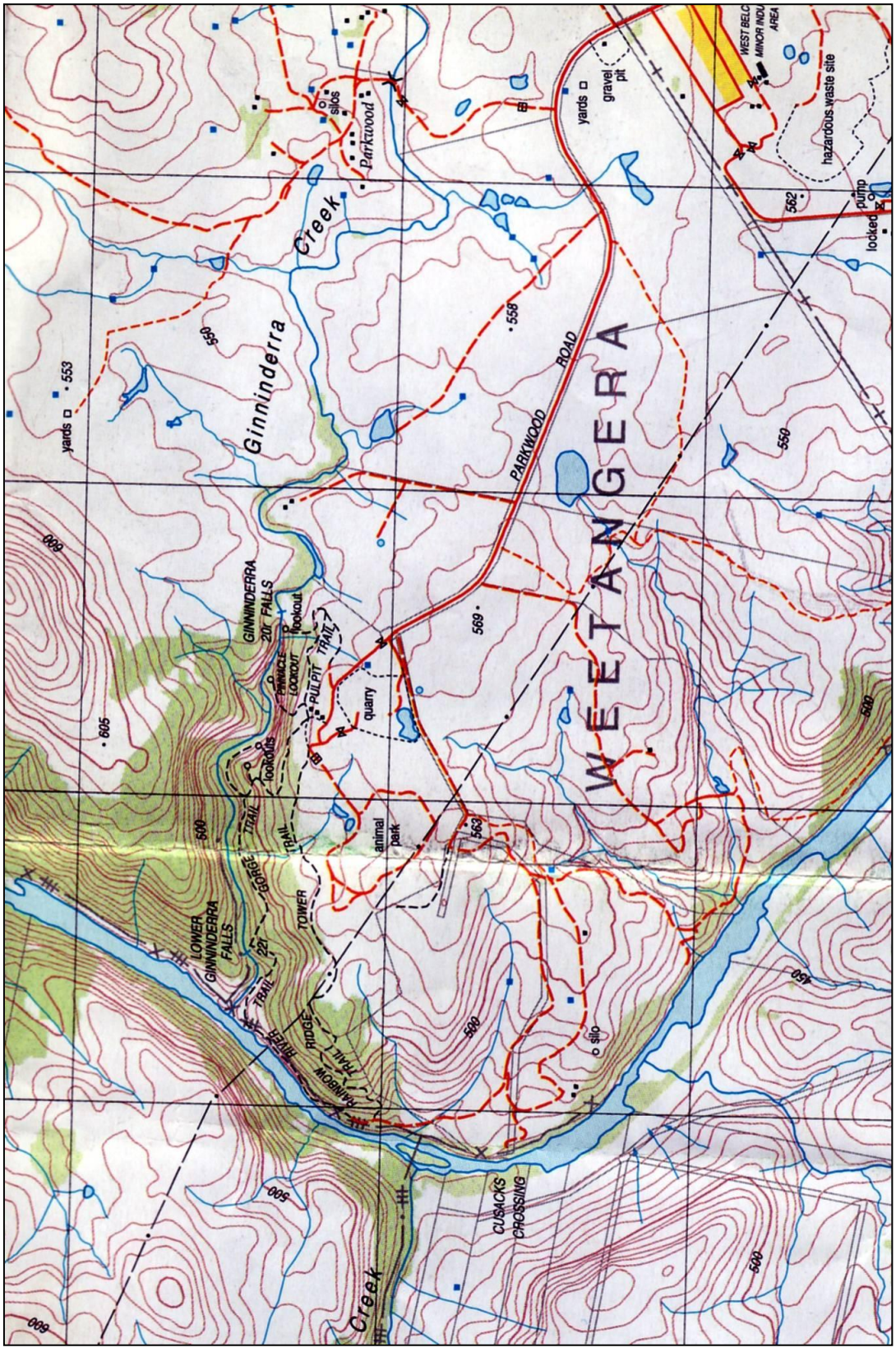
Columnar structures in Ginninderra Porphyry at an lookout near the upper falls.



Siluro-Devonian granite from the Murrumbidgee River corridor.

- In the area of interest the Paddys River Volcanics (Sv1) within the Hawkins Volcanic Suite crop out along the Murrumbidgee River corridor upriver from the granite outcrops.

Paddys River Volcanics outcrop along the Murrumbidgee River upriver from the unnamed Siluro-Devonian granite outcrop.



1:25,000 scale topographic map of the area of interest

Denudation and erosion

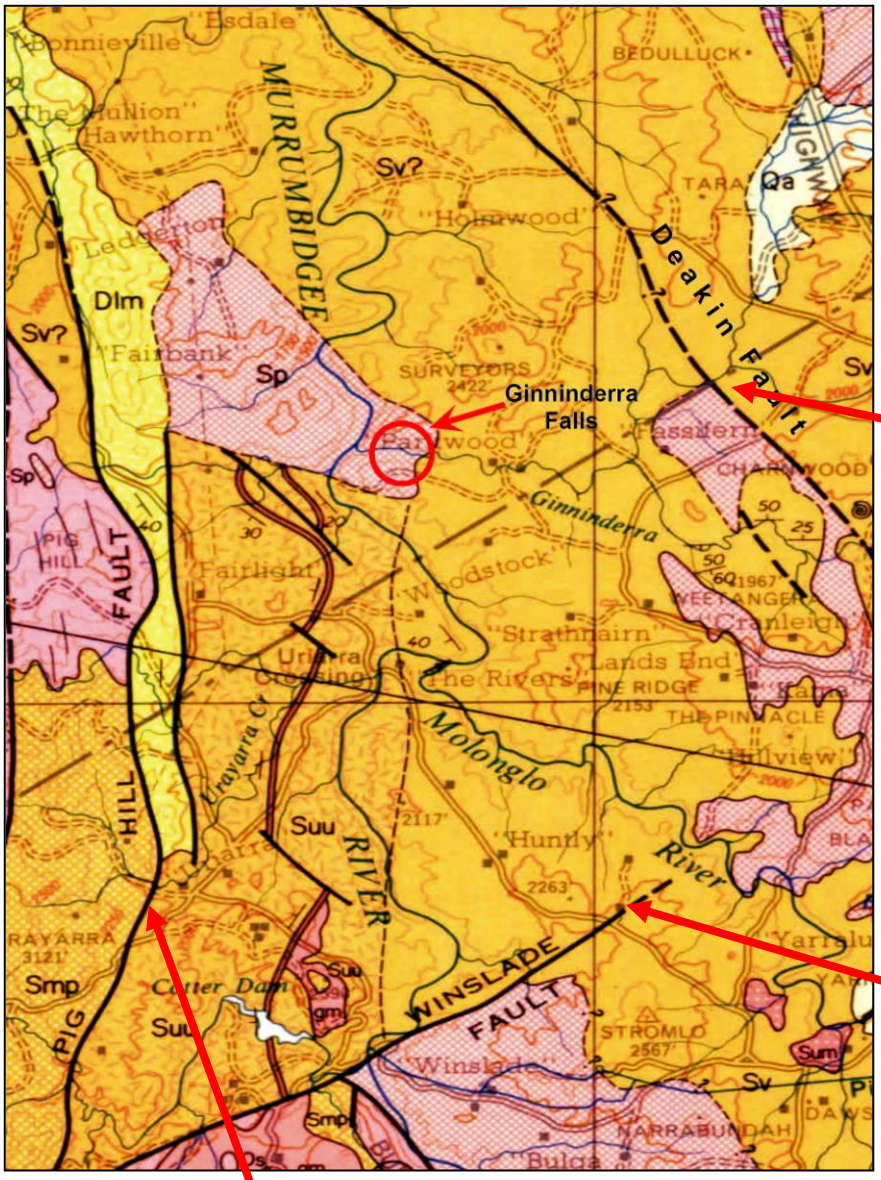
Denudation is the geological process by which the competing processes of tectonic uplift and erosion change the landscape throughout geological time. Tectonic processes at the margins of the Australian continent have led to uplift along eastern Australia in the last 100 Ma since the separation of Australia from Antarctica and the opening of the Tasman Sea. Weather patterns throughout geological time have resulted in erosion through changes in climate, glaciations and local weather. The denudation rate across Australia for much of last 400 Ma is about 5-10 metres per million years. This gives some idea of how the deeper rocks within the Earth's crust can be exposed at the surface over long period of geological history.

The pattern of drainage along river systems is controlled by the pattern and physical properties of geological formations/rocks and ancient fault systems. In the area of interest the Pig Hill Fault, the Winslade Fault and the Deakin Fault, together with other minor faults have controlled the drainage within the northern Murrumbidgee River catchment area (see extract from the 1:250,000 scale Canberra Sheet geological map below). Ginninderra Creek is part of that drainage system.

There are also local factors that lead to quite dramatic changes to river systems. For example, not far away to the east, the Lake George Fault has been active in the last 5-10 million years. The uplift on the western side of Lake George has led to river capture so that the lake now has no exit river. On a very recent timescale, human agricultural practices have led to erosion pattern changes, some very evident when driving along the Wallaroo Road from Hall.

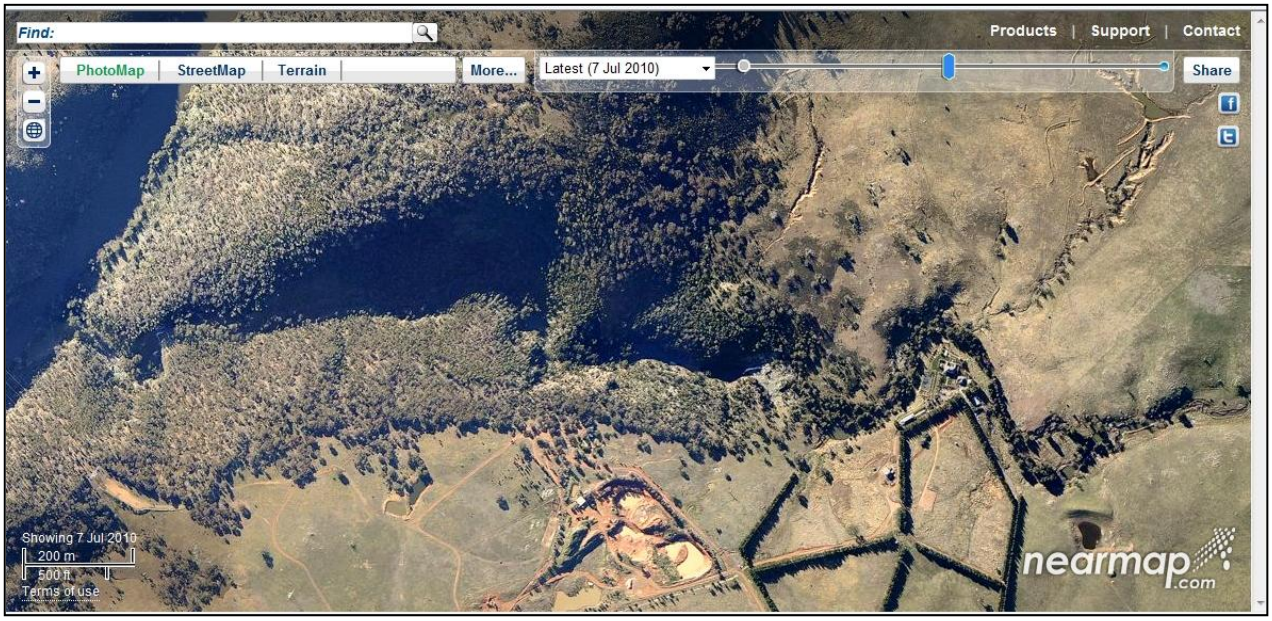
Care must be taken when changing land use to ensure that there are no unforeseen consequences to the landscape from erosion and degradation of river system environments and ecology. Within the area of interest, because of the steep gradients within the area, a change in land use can easily result in irreversible damage to the very attractive amenity and recreational potential of the Ginninderra Falls area. Ginninderra Creek crosses the relatively hard Laidlaw Volcanics along much of its length. However, the creek then crosses onto the slightly softer rocks of the Ginninderra Porphyry and the waterfalls have been formed over thousands/millions of years within the land area near where the creek flows into the Murrumbidgee River.

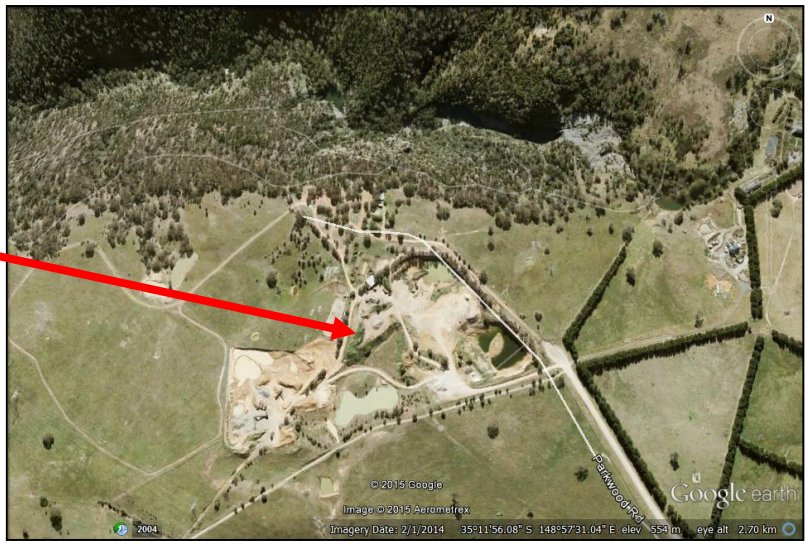
Erosion across grazing properties along the Wallaroo Road from Hall.



Extract from the 1:250,000 scale Canberra Sheet geological map showing major faults and drainage systems.

Confluence of Ginninderra Creek with the Murrumbidgee River.





Nearmap and Google Earth images of the lower Ginninderra Creek region.

Comments on descriptions of regional geology

In the commercial industry where stone is marketed for kitchen bench tops and horticultural purposes it is common practice to call all igneous rocks “granite”. In a similar vein all stone of sedimentary origin is commonly called “marble” or “sandstone”.

Geologically these terms are not accurate and may, in some instances be misleading. Thus in one description of the vineyards around Ginninderra Creek the publicity refers to *“...vines grown between 520-560 m on a northerly slope of granite soil.”*

Geologically igneous rocks can be divided into intrusive and extrusive rocks. Some intrusive rocks solidify deep with the earth at depths of, commonly 5-6 km. These rocks are geologically referred to as plutonic and can include granite, leucogranite, granodiorite, tonalite, etc. depending on their geochemical composition (all >20% quartz, etc). Over a long period of geological time erosion exposes these rocks at the surface. Thus we now see many plutonic rocks across SE Australia, the Murrumbidgee Batholith in Namadgi National Park being a collection of many plutons.

Extrusive igneous rocks are commonly erupted explosively from volcanic centres at the Earth’s surface and can be spread over a wide area. Deposits can be very thick. Depending on their geochemistry they can be referred to as dacites, rhyolites, andesites, etc. Depending on their mode of eruption at the surface from a volcanic centre they can be called ignimbritic, pyroclastic, etc.

View down Ginninderra Creek gorge.

Google Earth image of the lower Ginninderra Creek region.

Around the Canberra region the majority of the volcanic rocks can be loosely described as ignimbritic and were erupted about 400 million years ago from volcanic centres, much like the volcanic arcs of Indonesia and the Philippines today. What we now see around Canberra are the eroded remnants of that volcanic activity. However, sometimes intrusive volcanic rocks are also exposed with similar chemical compositions that take longer to cool and thus allow larger crystals to grow. They are then referred to as porphyritic, e.g. Ginninderra Porphyry.

Around the Lower Ginninderra Creek area the vast majority of rock outcrops are extrusive igneous rocks of the Hawkins and Laidlaw Volcanic Suites erupted during the Silurian geological period. The vineyards are planted on the soils derived from these rock suites.

Rhyodacitic ignimbrite of the Laidlaw Volcanic Suite along the Wallaroo Road.

Lower Ginninderra Falls.

Murrumbidgee River corridor and Lower Ginninderra Falls.