

Wannon & Nigretta Falls

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Geological Setting:

The Wannon and Nigretta Falls occur within 10km of each other at the edge of the late Cainozoic Western Districts Volcanic Province. However, they are developed in quite different styles on rocks of different age and character. The oldest rocks are Devonian volcanics (rhyolitic ignimbrites) seen at the Nigretta Falls and the valley of the Wannon River thereabouts. Further south, in the valley bottoms we find poorly exposed, soft, Cretaceous stream and lake sediments and Tertiary marine sediments. The plateau surface along the highway east and west of the Wannon Falls is a late Tertiary lateritic soil developed on the Tertiary sediments. In the Grange Burn valley, west of Hamilton, there is a local area of Pliocene sediments which contains vertebrate fossils. These lie immediately below the basaltic lavas of the Pliocene to Pleistocene Western District Volcanic Province.

The Character of the two falls:

At the **Wannon Falls** we have a spectacular, single, 30 m, vertical drop over a hard lava flow into a plunge pool. There are some rapids downstream that run around large blocks that have rolled down from the side walls of the narrow valley.

Contrast this with **Nigretta Falls** which are a more interesting, multi-channel cataract of smaller drops and bounces guided by patterns of joints in a much older volcanic rock.

Formation of the Wannon Falls:

The key to the formation of these vertical falls is the existence of a hard lava bed overlying softer rock. The plunge pool at the bottom of the waterfall erodes the softer rock and undermines the resistant cap (see diagram). Thus the whole waterfall slowly migrates upstream as a vertical face rather than degrading to a sloping set of rapids. The falls have moved upstream several kilometres since the lava flow initiated them. This has left the narrow gorge we see below the falls.

Whence came the lava flow?

The source appears to have been a (barely recognisable) volcano 10 km to the southeast. This basaltic lava flowed down the ancestral Grange Burn and then the Wannon River. Strange as it may seem, the lava flow appears to have flowed upstream in the Wannon River valley from its junction with the Grange Burn (see map). The valleys were not cut as deep in those days and although the bulk of the lava coming down the Grange Burn continued down the Wannon to the southwest, the volume of lava was sufficient for it to back up the Wannon valley for several kilometres to a point one km north of the present falls.

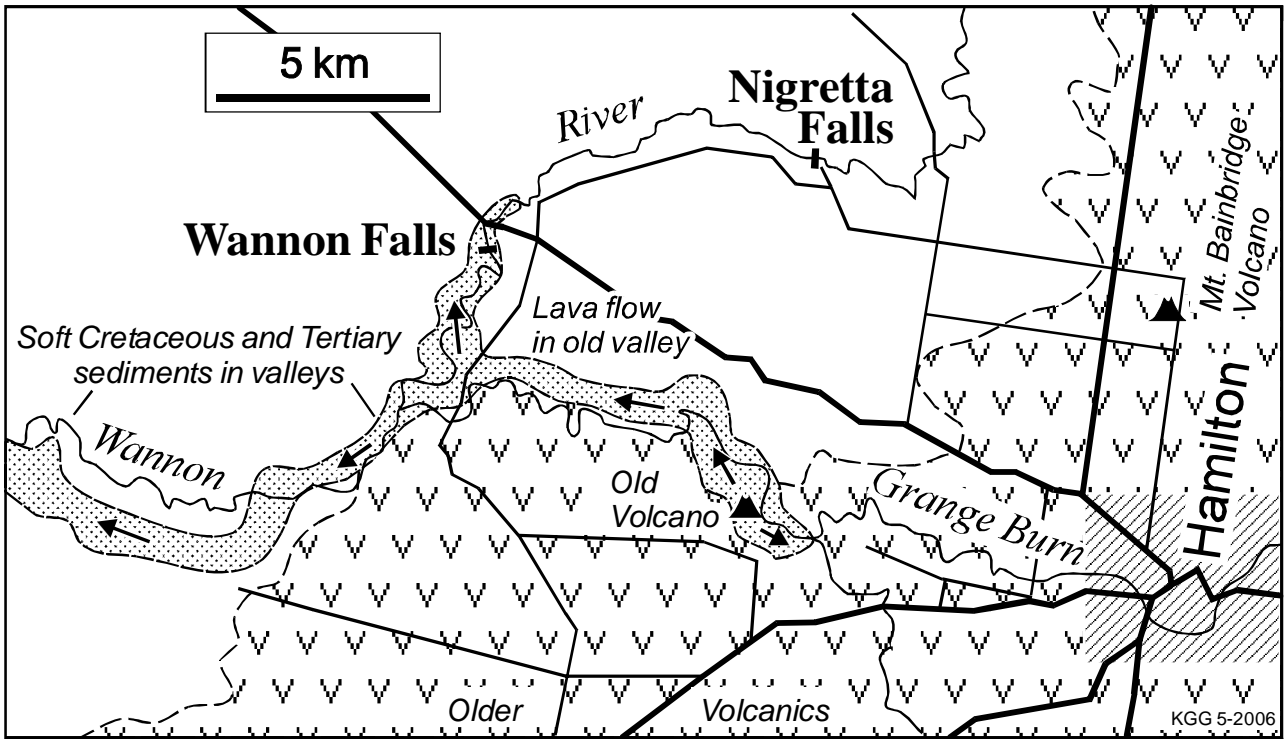
How old is the lava?

The lava flow at the Wannon Falls is probably between one to two million years old. Ideally we would like to date the basalt flow at the Wannon Falls using accurate isotopic methods, but it is too weathered for that. So, instead we have to use relative dating methods of comparing the flow to other features that have been dated. There are two main clues:

- 1: The lava flowed along a valley that had been cut deeply into older lavas that have been dated west of Hamilton at about four million years, so we know it is significantly younger than those.
- 2: The soils on this lava are not as thick as those on the older volcanics. However, they are better developed than those on the stony rises seen elsewhere in the region, which are all less than 500,000 years (by isotope dating). Thus the age of the flow lies between four million and half-a-million. Comparison of degree of soil developments suggests that an age of between 1 and 2 million is most reasonable.

Formation of the Nigretta Falls

The **Nigretta Falls** are also developed on a hard rock outcrop, but these have no underlying soft bed to allow easy undermining of the wall. Instead their form is more complex and controlled by the well-developed jointing (crack patterns) in the rock (see diagram). With time these falls will probably grade back to a set of rapids, rather than migrate upstream as a vertical face.



Map showing older volcanic areas (V V) and the later lava flow (dotted) that ran down the Grange Burn and backed up the Wannon River valley. Arrows indicate lava flow directions.

