Dating our volcanoes

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There is some confusion concerning the ages of the various volcanoes near Hamilton. This is a question of considerable import to some members of our tourism industry in their search for the 'youngest' volcano in the region. Part of the problem is that many of the dates cited in the scientific reports for the younger volcanoes are "minimum" ages based on dating of swamp deposits that formed after the actual eruption. The other problem is that the geologists are constantly collecting new samples and trying new methods so the dates keep getting revised – usually to an older age.

The ideal situation is where we can get an isotope date on the actual volcanic rock, which is basalt lava or scoria. The most common method for doing this is the Potassium/Argon (K/Ar) method. This method measures the decay of a radioactive isotope of potassium (K) to its daughter isotope, argon (Ar). At the time of the eruption any argon, which is a gas, is bubbled off from the lava so we start with zero and the amount builds up at a known rate. By measuring the ratio of the two isotopes we can calculate how long the rock has been solid. Unfortunately, this method is only useful for basalts older that about 100,000 years – for younger basalts not enough of the argon has built up in the rock to measure the concentration accurately unless you can afford some very fancy equipment.

Another method uses the radioactive isotope: carbon-14. This has a known quantity in the air, and after it is incorporated into organic material (e.g. wood or shell) it decays at a known rate. By measuring how much is left we can calculate how long it has been since the organism was alive (see figure). Errors can result from contamination by modern organic material.

A new dating method has been discovered more recently that measures the build up of isotopes on the surface of a lava flow as a result of cosmic radiation hitting it since it formed.

As it is difficult to get accurate K/Ar isotope dates directly from very young basalt lavas, many of the ages quoted for these have been based on radiocarbon dating of organic material from associated sediments – typically lake sediments within the craters, or peat deposits in swamps that were dammed up by lava flows down valleys. In both those situations the age estimate is a "minimum" one as the sediments are younger than the actual eruption by an unknown time. The original author may have discussed the relationships and the probability of the date being close to that of the actual eruption, but these discussions are seldom repeated when the date gets quoted elsewhere and people tend to forget that these are minimum ages – simply quoting the number as the actual date of the eruption. In several cases volcanoes that were once thought to be relatively young (from minimum ages) have had their ages pushed back when further material was found and dated. An example is Mt Napier, long referred to as "about 7000 years old" on the basis of a minimum radiocarbon age from Buckley Swamp, but recently re-dated to 32,000 years.

Volcano	**Age**, years	**Method**
Mt Rouse	~400,000	Several K/Ar isotope dates at the Port Fairy end of the long lava flow. An older date of 1.8 million years from Mt Rouse itself is thought to be erroneous.
Tower Hill	35,000	Minimum age from lake deposits within the crater.
Mt Napier	32,000	Dated by isotopes built up by cosmic radiation hitting the lava flow in the Harman Valley.
Mt Eccles	28,000	Minimum age from radiocarbon dates of associated swamp deposits in Condah Swamp
Mt Schank SA	5,000	Currently the youngest in the region. Based on "thermoluminescence": an effect that develops in sand grains after they are buried by the volcano.