

## Potential of muon tomography for identifying internal structure of the andesite volcanoes of Tongariro National Park, New Zealand

Tony Hurst<sup>1</sup>, Agnes Mazot<sup>2</sup>

<sup>1</sup>GNS Science, 1 Fairway Drive, Avalon 5040, New Zealand, New Zealand, <sup>2</sup>GNS Science, 114 Karetoto Road, RD4, Taupo 3384, New Zealand, New Zealand

E-mail: a.mazot@gns.cri.nz

Ngauruhoe (2287 m high) was New Zealand's most active volcano for over a century until 1975, when after a series of Vulcanian eruptions, it became quiescent. It is a steep conical volcano, which had an open vent about 200 metres deep in late 1973, which has since filled up. It is important in considering the hazard of future eruptions to know whether its former vent is blocked by solid lava or just rubble.

Tongariro (1967 m high) on the other hand, was dormant for over 100 years until a small steam and ash eruption on 6 August 2012. This opened a number of steaming vents and fissures. On 21 November 2012, a smaller eruption occurred, indicating that activity is continuing. With limits on access to the immediate area of the vents, investigations of the new vents will have to be done remotely.

Muon tomography offers a method to measure the density within the parts of a volcano that are above an observing point, and can potentially answer such questions.

For Ngauruhoe, we have calculated the effect on the muon attenuation profile of a density anomaly in the old vent region, based on measurements of the deep open vent that existed in late 1973, and using the current topography. This shows that an indication of any different density region within the upper cone can be obtained with a muon recording site on the summit of Pukekaikiore. This is an older nearby volcano, which could provide a more favourable site for a muon telescope, than the exposed slopes of Ngauruhoe.

For Tongariro, preliminary analysis suggests that we may be able to get limits on the vent diameter using a site on the northern slopes that is a safe distance below Upper Te Maari crater, where the recent activity is centred.