Geophysical Research Abstracts
Vol. 15, EGU2013-2372, 2013
EGU General Assembly 2013

Field mapping, geophysics, and age-data reveal volcano-tectonic interactions: the Paeroa linear vent zone within the Taupo Volcanic Zone, New Zealand

Drew T. Downs (1), Colin J.N. Wilson (2), Jim W. Cole (3), Julie V. Rowland (1), Andrew T. Calvert (4), and Graham S. Leonard (5)

(1) School of Environment, University of Auckland, Private Bag 92019, Auckland 1142, New Zealand, (2) School of Geography, Environment, and Earth Sciences, Victoria University, PO Box 600, Wellington 6140, New Zealand, (3) Department of Geological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand, (4) US Geological Survey, Volcano Science Center, 345 Middlefield Rd, Menlo Park, CA 94025, USA, (5) GNS Science, PO Box 30368, Lower Hutt 5035, New Zealand

Structural controls on the locations and styles of large, caldera-forming eruptions can be difficult to determine, even for geologically recent eruptions. Caldera collapse in rift settings is usually thought to be influenced by pre-existing, rift-related structures. However, caldera collapse is not always apparent as fissural eruptions of large ignimbrites occur too. Here we present data from a unique example in the central Taupo Volcanic Zone in New Zealand, where fault-controlled fissural eruptions of the moderately large, but localized, Paeroa Subgroup ignimbrites (>110 km3) occurred. These shortly post-dated the regionally extensive ignimbrites of the Whakamaru Group (>1500 km3) and the Rangitawa Tephra (∼700 km3), and their associated large (40 x 20 km) caldera collapse. All these eruptives are closely linked, based on stratigraphic position, petrology, and geochemistry. Using field evidence and age-determinations, however, we propose a distinction in their eruptive timings and vent sources. The regionally extensive Whakamaru Group ignimbrites return 40Ar/39Ar age-determinations on plagioclase of 350±3 ka (Rangitaiki ignimbrite), 349±3 ka (Te Whaiti ignimbrite), and 347±4 ka (Whakamaru ignimbrite), with a weighted mean age of 349±4 ka. The locally sourced Paeroa Subgroup ignimbrites, in contrast, return ages of 341±3 ka (Paeroa ignimbrite) and 335±4 ka (Te Kopia ignimbrite), with a weighted mean age of 339±5 ka. Analysis of age-dates yields a 95% probability that the Paeroa Subgroup is 5 kyr (or more) younger than the more widespread members of the Whakamaru Group. Recycled clasts of crystal-rich Whakamaru-like ignimbrite within the stratigraphically lowest Paeroa Subgroup sequence supports the notion that these ignimbrites were later erupted. Field investigations of lithic clast sizes, deposit thicknesses, and their distributions indicate that the Paeroa Subgroup ignimbrites were emplaced proximal to where they outcrop (within ∼3 km). Importantly, clasts are too large (1.5 to 4 m across) to have been transported >20 km from the inferred Whakamaru caldera rim. Corresponding with the stratigraphic data, an elongate gravity low (to -138 mGal) coincides with the trace of the Paeroa Fault, a 25 km-long normal fault that displaces the Paeroa Subgroup ignimbrites and reveals their greatest exposed thickness in the >500 m-high footwall scarp. Thus, using these stratigraphic and geophysical datasets, we propose that the Paeroa Subgroup ignimbrites were erupted from a narrow NE-trending feature (here termed the Paeroa linear vent zone) that closely coincides with the Paeroa Fault. The latter structure intersects the Whakamaru caldera to the southwest, and may have tectonically channeled residual magma to the northeast to erupt in a fissural style.