

Assessing volcanic hazard in Auckland, New Zealand, including new insights from cryptotephra studies

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Keywords: Auckland Volcanic Field, cryptotephra, reworking, uncertainty, frequency

The city of Auckland is built on and around a potentially active, basaltic, intraplate volcanic system, the Auckland Volcanic Field (AVF). The field hosts around 55 small volcanoes and has been active for the last ~200,000 years. The most recent eruption occurred from Rangitoto ~550 years ago and was witnessed by early indigenous Maori. Although the volcanoes in Auckland are small and their eruptions have been infrequent, the risk associated with future activity is high given the high physical and economic vulnerability of Auckland (population 1.5 million). Auckland may also be impacted by ash from distal eruptions in the Taupo Volcanic Zone, ~250 km to the south. Over the past decade five AVF craters have been drilled to extract cores containing tephra layers interbedded with laminated lake sediments to gain insight into the timing and frequency with which Auckland has been impacted by eruptions in the past. This has been particularly useful as very few dates were available for individual AVF volcanoes until recently. In the Holocene, at least five eruptions (three distal, two local) are preserved as macrotephra, reflecting an average frequency over this time period of 1 per 1,780 years. Recently, we carried out a detailed study of cryptotephra, using geochemical fingerprinting, stratigraphic correlation and other proxies to filter out reworked tephra and thus establish a new Holocene tephrochronological framework for the region. In addition to five primary macrotephra layers, 18 primary cryptotephra were identified. Geochemical characterization of well-dated rhyolite tephra in the record was used to establish tephra ages. To account for uncertainties, confidence levels were attached to the newly identified cryptotephra. Our results suggest that Holocene tephra fall from both local and distal volcanoes affected Auckland more frequently than previously documented, with a possible average frequency of at least once every 424 years.