



Tracking the extent of the Kuwae tsunami

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Recent geological analyses of a coastal deposit in Vanuatu, coupled with radiocarbon-dated shell and wood, confirmed that it related to a tsunami caused by the Kuwae eruption. Previous ice core data place the eruption around 1452/1453AD. The event, which created a 12 km long, 6 km wide oval-shaped submarine caldera between the islands of Epi and Tongoa, has been assigned a VEI of 7 and as such is believed to have been larger than the 1815AD Tambora eruption, with a minimum 100 km³ of pyroclastic deposits and an eruptive mass of 1×10^{14} kg. There is a wealth of data concerning the depositional evidence for the eruption event, but until 2008 there was no physical evidence for any tsunami.

Recent research has also pointed to the Kuwae eruption as a possible source for high elevation palaeo-tsunami deposits in the far north of New Zealand, and along the coast of Futuna Island in the Wallis and Futuna archipelago. Other pieces of potentially contemporaneous evidence from the mid-South Pacific point to this volcanogenic tsunami having been a significant region-wide event. We do not however, know whether the tsunami was a large enough event to affect the remainder of the South Pacific, as might be the case from the data listed above.

We outline evidence from the key sites in Vanuatu, New Zealand and Futuna Island, and provide information from other potential relevant locations within the South Pacific. This provides a picture of the potential effects of the tsunami to the east and south of the Kuwae caldera. As with many similar lines of palaeotsunami evidence, this raises questions about the full extent of the tsunami and the degree to which countries to the north and west might have been affected.

The most proximal palaeotsunami site in Vanuatu is also one of the smallest reported, both in elevation above sea level and thickness. This is hardly surprising given the proximity to the caldera and we hypothesise that it only preserved on the eastern shores of Tongoa because they were relatively sheltered from the main Kuwae eruption. Even so, with the massive amounts of ignimbrite material, the deposit is easily overlooked. The most compelling find on Tongoa is a burnt tree rafted on top of a bed of pumice. The tree and rafted pumice form the upper layers of a palaeotsunami deposit approximately 40 cm thick. The lower portion consists of a sequence of small pebbles and gravel fining-upwards to a fine sand.

This proximal deposit contrasts markedly with those purported to relate to the Kuwae eruption in both New Zealand and on Futuna Island. In New Zealand, a series of contemporaneously-aged sites rise to up to 42 metres above sea level, while those in Futuna can be traced around the entire island. Are these related to the Kuwae eruption or is there an alternative source? What about the other possible sites – do they point to a more significant region-wide source? Ultimately the question must be: what was the full extent of the Kuwae tsunami and what are the implications for tsunami risk in the region?