

Tsunamis caused by volcanic eruptions investigated by tephra and tsunami deposits

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We investigated timing and scale of tsunamis caused by volcanic eruptions based on the tsunami deposits. In 1994, two volcanoes located at the western and eastern side of Rabaul caldera, Papua New Guinea, broke into eruption. According to the eyewitness accounts and reported damages, tsunamis were generated during the eruptive activity and estimated to be attacked several times at the Matupit Island, south of Rabaul.

In 1999 and 2001, we conducted brief surveys around Rabaul and identified tsunami deposits as sand layers or characteristic pumiceous sand (mixes pumice and sand) layers which are sandwiched by tephra from Vulcan and Tavurvur Volcanoes. According to the chronological studies of both tephra and tsunami deposits, it is inferred that the tsunami was not generated by the first small eruption from Vulcan. The tsunamis were excited several times by larger pyroclastic flows and base surges during the following climactic stage of the volcano. Tsunami run-up heights estimated from distribution of the tsunami deposits are ca. 5 meter around western to southern shore of the Matupit Island. These are consistent with the other evidences such as eyewitness accounts, reported damages and numerical simulation results.

Tsunami deposit which are overlaid with tephra have been found also for a paleo tsunami event of volcanic origin. In 1640, a tsunami attacked Uchiura Bay and killed more than 700 people. At a site near the volcano, Washinoki, a significant sandy layer is deposited on the original surface and overlaid directly with a thin blast ash fall deposit from the Komagatake. These geological evidences show that the tsunami occurred associate with the cone collapse at the first stage of the eruption. The maximum height we could trace up the deposit at the site is ca. 6 m.

In cases of the 1994 Rabaul and the 1640 Komagatake events, the tephra might play an important role to preserve the original spacial distribution and lithofacies of the tsunami deposits. They provide rare opportunities to know timing and scale of tsunamis of volcanic origin and also to study general depositing process of such sand layers.