

Trapdoor faulting at submarine calderas in Japan and New Zealand: Its potential for volcanic tsunami generation

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Volcanic tsunamis can be generated by different mechanisms, such as submarine explosion, flank failure, pyroclastic flow, caldera collapse, volcanic earthquake, or interaction between acoustic pressure waves with the ocean. In this talk, I introduce a source mechanism of volcanic tsunamis newly found at submarine calderas in Japan and New Zealand. At these submarine calderas, moderate-sized earthquakes with seismic magnitudes of M5–6 repeated quasi-regularly and unusually caused tsunamis, sometimes with a maximum wave height of about a meter, but the source mechanism of the earthquakes/tsunamis has been unclear for four decades. Our source modeling approach using the tsunami and seismic waveform datasets revealed that the so-called trapdoor faulting, or sudden caldera uplift involving a large intra-caldera fault slip of meters, took place in the submarine calderas due to high magma overpressure and generated the earthquakes and tsunamis. These findings of submarine trapdoor faulting with high potential for the tsunami generation underscore our need to examine/monitor submarine calderas for assessing volcanic tsunami hazards. Additionally, the quasi-regular recurrence of trapdoor faulting reflects their active volcanism under ocean, strongly suggesting its potential for submarine eruptions in the future.