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巨大地震とそれにより励起された火山活動の時間間隔は何が決めるか？
What controls the time interval between gigantic earthquake and its induced volcanic eruption?

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It is well known that some volcanic eruptions were triggered by large earthquakes. Although volcanic eruptions that take place soon after (day to a year) the triggering earthquake are counted in this category, here I propose that some volcanic eruptions may take place 30 to 50 years after the triggering big earthquakes. First example that I propose is the synchronous start of modern volcanic activity of three volcanoes in Hokkido, Komagatake (started 1640AD after dormant period of ˜3000 years), Usu (started 1663AD after dormant period of ˜5000 years) and Tarumae (started 1667AD after dormant period of ˜3000 years). Change in crustal stress field caused by large earthquake may be most plausible reason to explain the synchronous volcanic activity. Analysis of tsunami deposit in Hokkaido revealed that large earthquake >M8.4 took place in the early 17th century at Kuril trench east of Hokkaido (Nanayama et al 2003, Nature). This may be the source of the Keicho-tsunami earthquake in 1611. Because earthquake was not recorded, magnitude of this earthquake is uncertain. It may be one of the M9 class earthquakes. If modern activity of Komagatake, Usu, and Tarumae were triggered by the 1611 M9? Keicho earthquake in Kuril, then interaction time between the earthquake and the volcanic eruption is 30 to 50 years.

According to A.Hasegawa (personal communication), 2011 March 11 Off-Tohoku M9 earthquake caused dramatic change in crustal stress field in North Honshu Arc. Source mechanism of crustal earthquakes changed from reverse fault type to strike slip type in most part. Even normal fault type earthquake has started after the great earthquake. These lines of evidences indicate that regional stress field changed from horizontal compression to horizontal extension as a result of the M9 earthquake. Similar change in crustal stress field may have happened in Hokkaido after the M9? Keicho earthquake. Injection of large amount of basalt magma from mantle source to crustal magma chamber may have started after the Keicho earthquake and may still continues. This increased magma flux from the mantle may have triggered the eruption in the three volcanoes 30 to 50 years after the Keicho earthquake.

Following Jogan great earthquake (869 AD, >M8.4), only 871AD eruption of Chokai volcano is recorded. However, if we allow volcanic eruption 30 to 50 years after the earthquake, the last eruption of Towada volcano (Towada-A) that took place in 915 AD may be counted as a possible eruption triggered by Jogan earthquake. Towada volcano erupted episodically in the last 150000 years. Interval time between Towada-A and Towada-B is about 1700 years. It is plausible that silica-rich magma chamber beneath Towada caldera volcano was activated by injection of large amount of basalt magma from mantle source due to stress drop caused by the Jogan great earthquake.

If activity of a volcano is controlled by enhanced flux of basalt magma from mantle source to crustal magma chamber, why volcanic eruption take place 1 to 50 years after the triggering earthquake? In the conference, I will discuss the mechanism that will determine the characteristic reaction time. In the volcano at which basalt magma plumbing system is established from the bottom of crust to the top, characteristic reaction time would be as short as ˜1 year. Fuji volcano and Iwate-Akitakomagatake may be in this category. On the other hand, lessons in 17th century in Hokkaido indicate that characteristic reaction time would be 30 to 50 years in the case of volcanoes which has complex magma plumbing system consisting of basalt and silica-rich magma. Most Quaternary volcanoes in North Honshu Arc may be in this category. It is essentially important to estimate their future activity after the 2011 March 11 M9 Off-Tohoku earthquake.

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