Recurrence interval of morphogenic earthquakes on the Futagawa-Hinagu Fault Zone that triggered the 2016 M_w 7.1 Kumamoto earthquake, SW Japan

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Large earthquakes of magnitude >6–7 with shallow focal depths can produce distinctive coseismic surface ruptures and cause strong ground deformation. Such large-magnitude earthquakes are called morphogenic earthquakes because they are capable of generating or modifying surface morphology instantaneously and permanently. Morphogenic earthquakes can generally be identified via trench surveys that reveal features of ground deformation preserved in sedimentary horizons.
The 2016 M_w 7.1 (Mj7.3) Kumamoto earthquake, which occurred in central Kyushu Island, southwest Japan, produced a ~40-km-long surface rupture along the Futagawa-Hinagu-Fault Zone (FHFZ) that cuts across Aso caldera. Field investigations related to the Kumamoto earthquake, trench excavations across the Hinagu and Futagawa faults, and radiocarbon dating results reveal that 1) prior to the 2016 earthquake, at least two morphogenic earthquakes occurred in the past ca. 2000 years on the Hinagu Fault, and four events in the past 4000–5000 years on the Futagawa Fault, suggesting an average late Holocene recurrence interval of 1000 years for morphogenic earthquakes within the FHFZ; and 2) the most recent event occurred between AD 1000 and 1400. These results contradict previous studies that estimate recurrence intervals for morphologic earthquakes of 3600-11,000 years and 8000-26,000 years on the target segments of the Hinagu and Futagawa faults, respectively. Our findings show that recent activity, including the recurrence intervals of large earthquakes and slip rates in the HFFZ, were previously underestimated; therefore, it is necessary to reassess the seismic hazard posed by the HFFZ, particularly for densely populated areas of Kyushu, Japan.

Reference: Lin et al. (2016). Coseismic rupturing stopped by Asovolcano during the 2016 Mw 7.1 Kumamoto earthquake, Japan. Science, 354, 869-875.

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