

Tephra stratigraphy for establishing active faults history in the western part of Aso Caldera, SW Japan

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Abstract

The 2016 Kumamoto earthquake (Mjma = 7.3) occurred on April 16, 2016 in Kumamoto Prefecture, SW Japan. The 30 km-long surface rupture associated with the earthquake appeared along the previously mapped active Futagawa fault. The earthquake gave damages to the cities of Mifune, Kumamoto, Mashiki, Nishihara and Minami-Aso along Futagawa fault, from the Kumamoto plain, to inside Aso Caldera, with destruction of more than 8000 buildings. Numerous slope failures affected infrastructure in and around the caldera. The recurrence interval of large earthquakes on active Futagawa faults is an important parameter in assessing seismic hazards. In order to clarify it, it is necessary to investigate the displacement and deformation of the stratum by outcrop observation. The tephra layer is a good tool because it is easy to detect deformation of the formation and display the age. Since Aso area is covered with the tephras of the post-caldera volcanism, these tephras can be used as key layers to clarify the history of earthquake events. Previous studies described the stratigraphy of tephra layers originates from Aso post-caldera volcanism, mainly at eastern part of caldera, because they distribute to the east side of the vents. In the western part of caldera, which was damaged by the Kumamoto earthquake, accurate tephra stratigraphy to establish history of fault activity was insufficient. Therefore, we conducted a geological survey to establish tephra stratigraphy in the western part of the caldera. Many new outcrops have appeared as the result of field work and drilling survey in this area for the restoration of the afflicted area, and a lot of information could be obtained.

We recognized the scoria fall deposits around 50 ka and found that this tephra can be widely traced to the western part of the caldera. We would like to discuss active fault history on the basis of the survey results on the tephra. The preliminary interpretation of the outcrop at Saikaku-yama shows that the tephra lower than the upper one is significantly more deformed, so it is clear that the mutation is cumulative. This fact indicates that faulting is repeated after 50,000 years.